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MECCANO MAGAZINE

HUNTING THE SUBMARINE

(See Page 146)

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Next Month: "THE FAIREY 'BARRACUDA'." By J. W. R. Taylor

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With the Editor

The Stephenson Legend

The belief that George Stephenson was "the inventor of the steam locomotive" seems to be almost as widespread as ever. The inaccurate statements made by the well-meaning but hopelessly unreliable Samuel Smiles, in his famous biography of Stephenson, have been copied by one writer after another until a Stephenson legend has grown up that will be very hard to destroy.

The truth is that George Stephenson did not invent the steam locomotive, or even any vital part of it. He had very little share in the design of the "*Rocket*," with which he is popularly associated; and in spite of the claims of Smiles and many other writers he did not invent the blast pipe. Stephenson's claim to fame lies not in his locomotive inventions, but in his splendid achievements as a railway engineer, for which the world owes him a great debt.

Timothy Hackworth, a short account of whose career appears in this issue, was a man of entirely different type. He was in the real sense an inventive genius, and his work may truly be said to have laid the foundation of the modern locomotive. He was almost certainly the inventor of the blast pipe. He was the first to use six coupled wheels, to apply waste steam to heating the feed water, and to use eccentrics to work the feed pumps; and he substituted spring-loaded safety valves for the weighted type. In his "*Royal George*" of 1827, when the fortunes of steam haulage were at a low ebb, he produced the first locomotive that really earned its keep in traffic on a public railway.

His work is well summed up by Robert Young in his notable book "*Timothy Hackworth and the Locomotive*," to which the writer of our article is much indebted: "In every engine Hackworth built he strove to produce some improved feature which should add to the efficiency of his locomotives, and this plan he consistently followed up to the production of his last engine, the '*Sanspareil*' of 1849. He always had before him the idea of a higher standard."

Meccano Helps a Draughtsman

A correspondent sends me the following interesting story. In a certain aircraft design office, the layout of a suitable undercarriage retraction linkage or mechanism was proving a very sticky problem. Finally the draughtsman concerned took a week-end off and got busy at home with his Meccano, long put away. On the Monday he took with him to work the solution to the problem in the form of a complete chassis in Meccano. This was used for months in the drawing office to demonstrate what is a clever and tricky chassis. This aircraft is now in production.

This Month's Special Articles

Hunting the U Boat

By Capt. Bernard Acworth, D.S.O., R.N. (Retd.)

THERE was a time not long ago when the U boats (Unterseeboote) were our greatest menace in this war as they were in the last. In April, 1917, we were within a few weeks of defeat owing to the loss of merchant ships at a far greater rate than they could be replaced. Up to that fateful month merchant ships were still sailing singly while warships "patrolled the trade-routes." Convoy had been opposed by those in authority on the ground that it "put too many eggs in one basket." But in April, as a last resort, the advocates of convoy were given a chance of testing their strategical and tactical ideas, with the results that we know. Convoy saved us. Only 0.5 per cent. of ships sailing in convoy were lost. Why was this? The reason is simply explained.

First, and foremost, in the last war a large group of ships was almost as difficult for U boats to locate as was a single ship, so vast are the ocean spaces. Thus if 50 ships sailed in close formation, the U boats had little more than one-fiftieth of the chances of sighting a target. This was the chief cause of convoy success. The second one was the concentration of the defence of these grouped merchant ships instead of scattering patrol vessels over the seas and oceans where hunting for U boats was like hunting for the proverbial needle in a haystack. In a sentence—convoy substituted for many small single unprotected targets one large well protected one.

Yes, you may say, that is clear and we already know it. But why, for the first three years of *this* war, did convoy fail to give the protection that it did in the last one; and why is it now, at long last, proving once again successful? The answer is two-fold. First, long-ranging aircraft have made it possible to locate and report the large slow-moving convoys far out at sea, thus enabling the U boats to mass (pack) against the on-coming convoy. Second, owing to the pre-war disarmament policy, we had totally insufficient escort ships to protect our convoys against concentrated U boat attack.

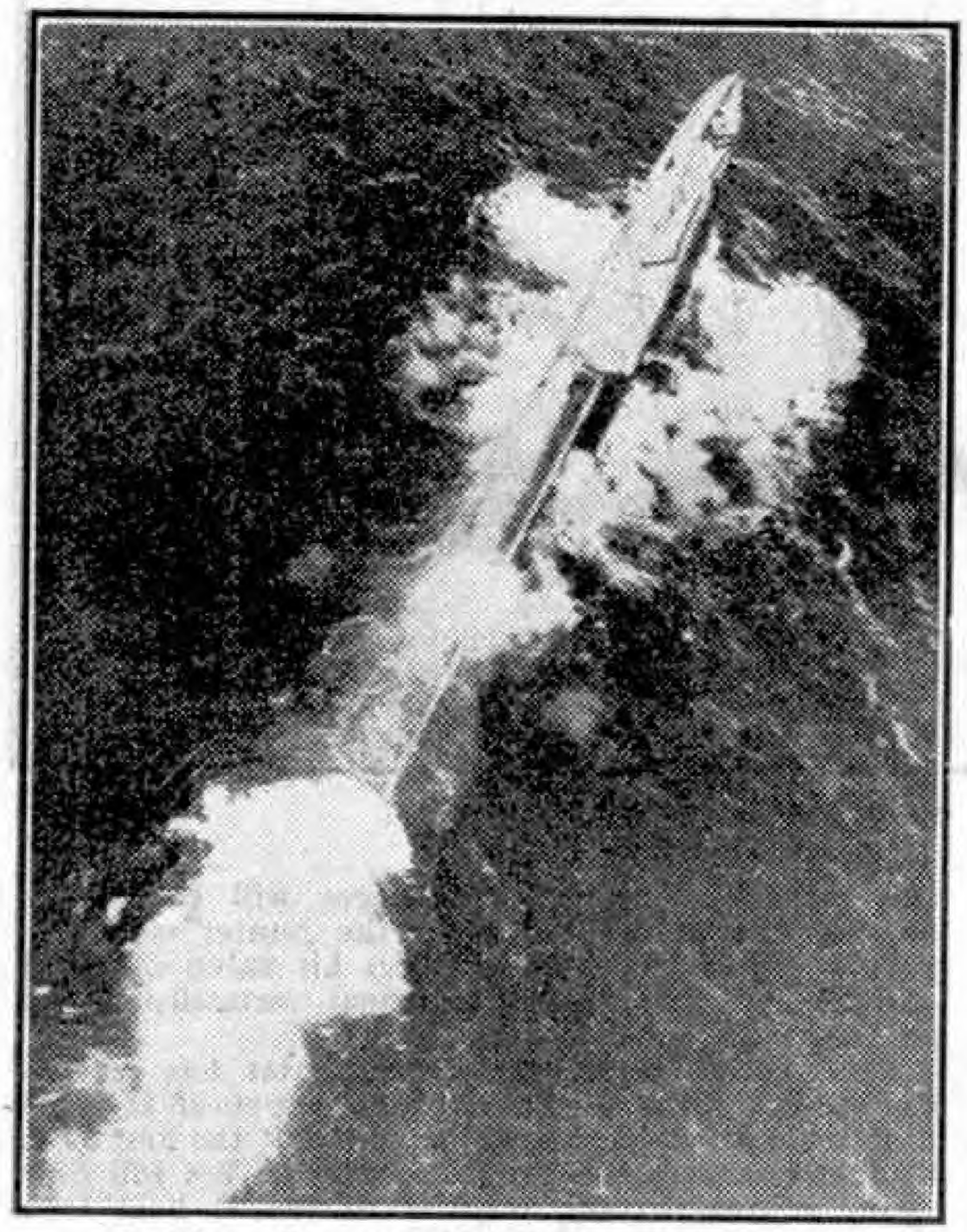
Thus it will be seen that although convoy has lost most of its strategical virtue of eluding attack altogether, it has retained and strengthened its tactical value of defence against attack since our means of defence—escort vessels and aircraft—have multiplied in the later stages of the war.

Keeping watch over the convoy.

I will now turn to the various methods of hunting and destroying U boats, and the grim and nerve-racking experiences which are the common lot of all those, British or German, who go under the sea in ships and occupy their grisly business in great waters—to paraphrase the CVII Psalm.

In order to get a clear idea of the various forms of attack to which U boats are subject it is necessary to outline the three sets of circumstances in which they may be located—First, when a U boat is sighted on the surface on passage to her allotted patrol area or ocean rendezvous; second, when a U boat sights an isolated ship, or a convoy, and proceeds to attack submerged; and third, when U boats, organised in packs, receive information by wireless of the position, course and speed of a convoy that will pass within reach of the pack in the course of the next few days.

In the first case the object of the U boat



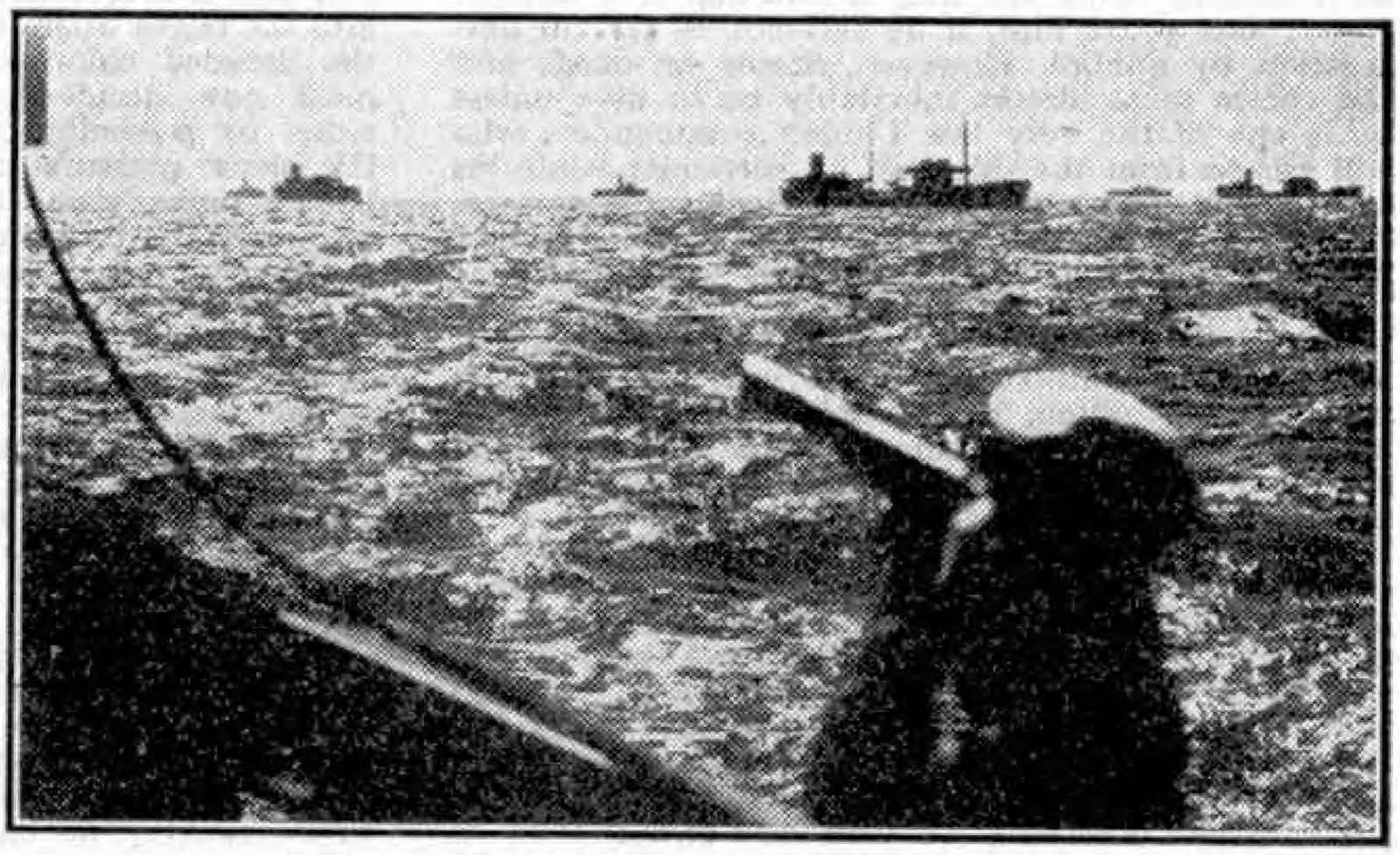
A submarine surfacing in a frantic hurry.

is, if possible, to reach her destination unobserved. Because a submarine lies so low in the water when on the surface, she can generally sight an enemy patrol craft before it sights her. She can thus submerge until the patrol craft has passed over the horizon. An aeroplane, on the other hand, is likely to sight the U boat first and to approach her at 200 m.p.h. or more. The U boat may either remain on the surface and engage the aircraft with her anti-aircraft guns, or submerge and face the slight risk of being accurately bombed under-water. The U boat commander knows that the attack cannot be sustained, owing to the few bombs carried. The decision as to whether to engage on the surface, or to seek safety by diving, will therefore depend on the mentality of the captain. It is doubtful if many U boats have been destroyed on passage to their rendezvous.

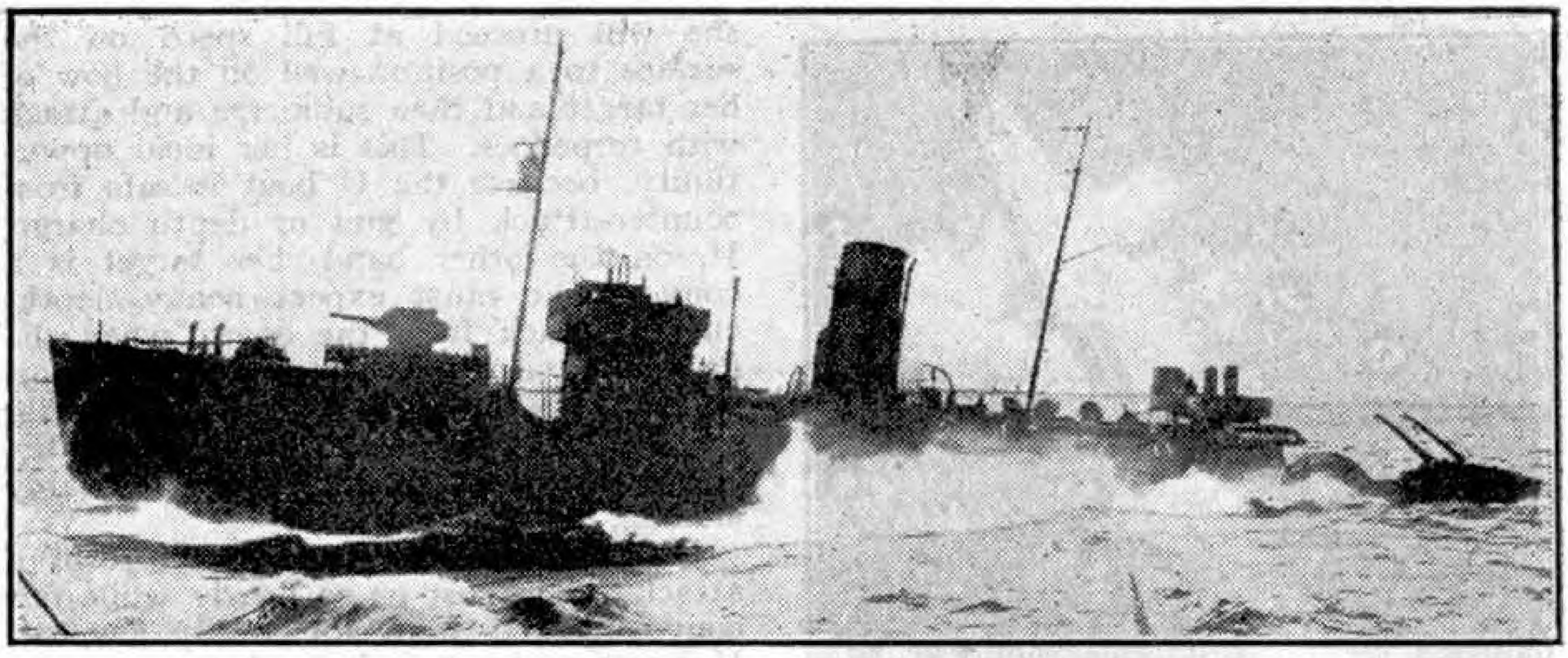
In the second case, if the U boat sights an isolated merchant ship, she will proceed at full speed on the surface to a position well on the bow of her target and then submerge and attack with torpedoes. This is her ideal opportunity, because the U boat is safe from counter-attack by gun or depth charge. If, on the other hand, her target is a convoy, she must expect heavy depth-charge attack from the escort when she has disclosed her presence by firing torpedoes. In this case the U boat would probably seek safety by diving under the convoy, thus confusing, and probably eluding, the hunters.

In the third case, which is the form of attack which cost us so dearly while our convoy escorts were lamentably few, the U boat packs "shadowed" the convoy, hull-down, during the day, and as night fell they proceeded at full speed at, and even into, the massed shipping, engaging the merchant ships on the surface with torpedoes and guns. The resulting confusion and darkness generally enabled the U boats to make their "get away" safely at high speed on the surface. In short, U boat packs operated mainly as *destroyers*, using their power of submergence primarily as a means of avoiding detection rather than as a means of attack.

But the multiplication of British and American surface escort vessels, and of long-range aircraft, and aircraft carried in small escort carriers, has added immeasurably to the difficulties and dangers of the U boats. By day, escort vessels stationed far out from the convoys have forced the U packs to submerge, thereby slowing them up to two or three knots with the result that they have generally failed to maintain a favourable position for massed



The convoy steams on.



Canadian corvette on convoy duty.

night attack. Aircraft have had the same effect, but with the added advantage that, unlike the surface escorts, they generally sight the U boats, so that they not only force comparative immobility upon them, but also attack them with bombs and, what is more deadly for the U boats, call up the surface escorts to hunt them.

That, as briefly as possible, is what the U boats now have to face, and the remainder of this article will be devoted to a short account of how they are hunted and destroyed by specially equipped anti-submarine craft.

Let us assume that one of a pack of U boats has succeeded, in spite of the difficulties I have outlined, in bringing off a surface attack on a convoy at night. Having fired her torpedoes she will make off at full speed on the surface, hoping that the darkness will cover her surface "get-away." But in a few minutes a searchlight beam envelops her and the U boat commander knows that he is spotted. A few moments later the thud and splash of 4.7 in. shells assures him that he must either fight it out on the surface or submerge and seek safety by evasion instead of by fighting. Terrible, indeed, is his dilemma because on the surface, against a well-gunned escort vessel, his chances are almost hopeless, while if he submerges he and his crew have to face the terrible experience of being hunted by the dreaded Asdic detecting apparatus and of feeling the quivering shocks from salvoes of depth charges drawing ever closer to the fatal distance from the hull. Below him is a mile of water, and above him, if he surfaces, is certain destruction by gunfire. However, choose he must, and the choice must almost inevitably be to dive unless he is one of the very few U boat commanders who will escape from the dilemma by surrender while his ship is still seaworthy above and below the surface.

In almost every case, therefore, the pursuing hunter in the beams of his searchlight will see the U boat slowing down, her stern rising, and her bow submerging. In 40 seconds, or so, she will have vanished and the slow cold-blooded hunt will start. Let us first, in imagination, place ourselves in the hunting craft fitted with the Asdic Detector and scores of depth charges of immense explosive power which can be "set" for various depths.

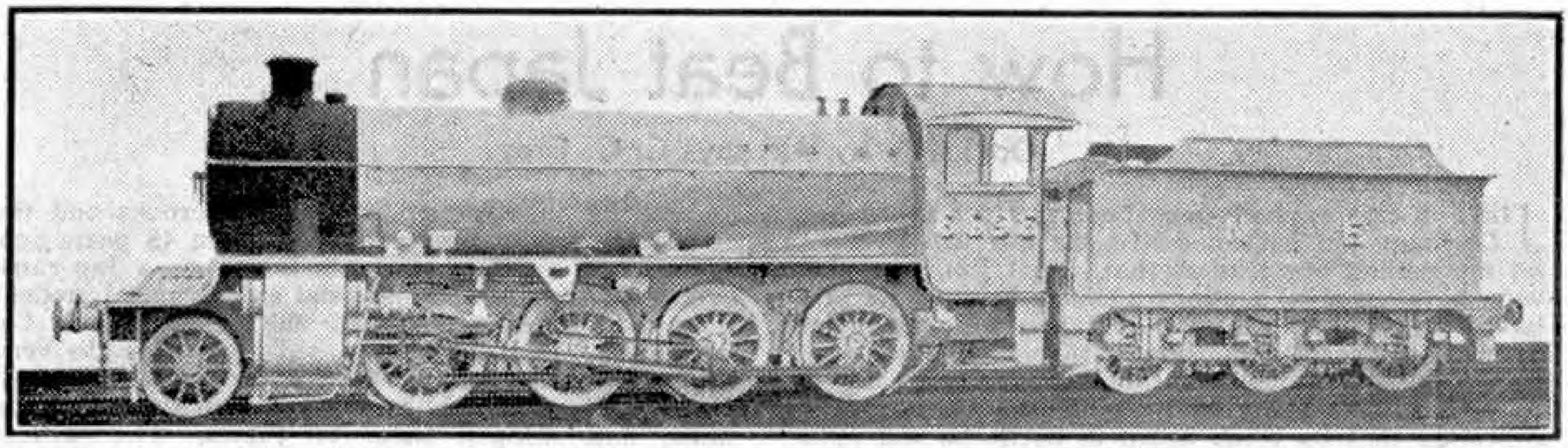
As I cannot give details of the detecting device I must content myself with saying that, in reasonably suitable weather conditions, it enables the operator to report the bearing and range of the U boat within a degree of bearing and a few yards of range. Nothing that the hunted U boat can do by silencing herself can prevent this information of her range and bearing reaching the captain of the hunter. Herein lies the fundamental difference between the hydrophone of the last war and the Asdic of this one. Only in the matter of depth is there guess-work. To overcome this weakness, the depth charges will be set for various depths so that when the hunter calculates that he is in the right position his salvo of depth charges will "straddle" the U boat vertically as well as horizontally.

Let us now assume that the hunter has reached the correct position with the high degree of accuracy that the Asdic makes possible, and that the first salvo of depth charges has been discharged. We will now, again in imagination, transfer to the U boat from the moment it "crash-dived."

The commander, if his nerves are sound, will probably go down to, perhaps, 500 feet, because at so great a depth the depth charges are likely to be less accurately placed when they explode, and the majority will explode above him. The sound of the hunter's propellers will be heard approaching, and when this is overhead the crew will know that the shock of their lives is about to happen. It comes with a sickening but muffled roar, and the boat's thin steel walls, which preserve the little bubble of air in the ocean depths, quiver. In order to save space, and in one brief account to cover a variety of possibilities, I will assume that this particular U boat, instead of being destroyed, goes through the same experience as I did nearly 25 years ago, except for the vast difference that I was attacked by mistake by friends and not foes. Though the shell of the U boat is not shattered, water streams in through damaged joints and seams. She takes on a heavy angle, and acid streams from the great secondary batteries into the bilges where contact with salt water generates the dreaded chlorine gas. The commanding officer must now decide between almost certain death—either by poisoning or the collapse of the shell from the sheer pressure of the sea—or, by blowing all ballast tanks, rising to the surface where some may escape death by surrender, while the U boat, with sea-valves open, sinks to the depths.

As we know, in scores of cases the U boats have surfaced, and sometimes have even fought a forlorn action with their gun. But the end is certain, as the thousands of U boat prisoners in our hands testify. When, in my own case, I emerged from the conning tower, the white ensign saved my boat from destruction by the gunfire of American destroyers. The German ensign would not provide this comforting sequel!

These, very briefly, are the sort of experiences which almost daily face the German U boat crews, and frequently the officers and men of our own submarines. Some may think that they might result in a shortage of volunteers for such nerve-wrecking service, but it is not so. Whatever may be the case with our enemies, whose bravery no one questions, British submarines will never lack a stream of recruits to whom great dangers are not a deterrent but an incentive.



The first of the new L.N.E.R. Class "01," a conversion from the Class "04" 2-8-0s of Great Central origin. An engine of Class "04" is seen at the foot of the page.

A Rebuilt L.N.E.R. 2-8-0

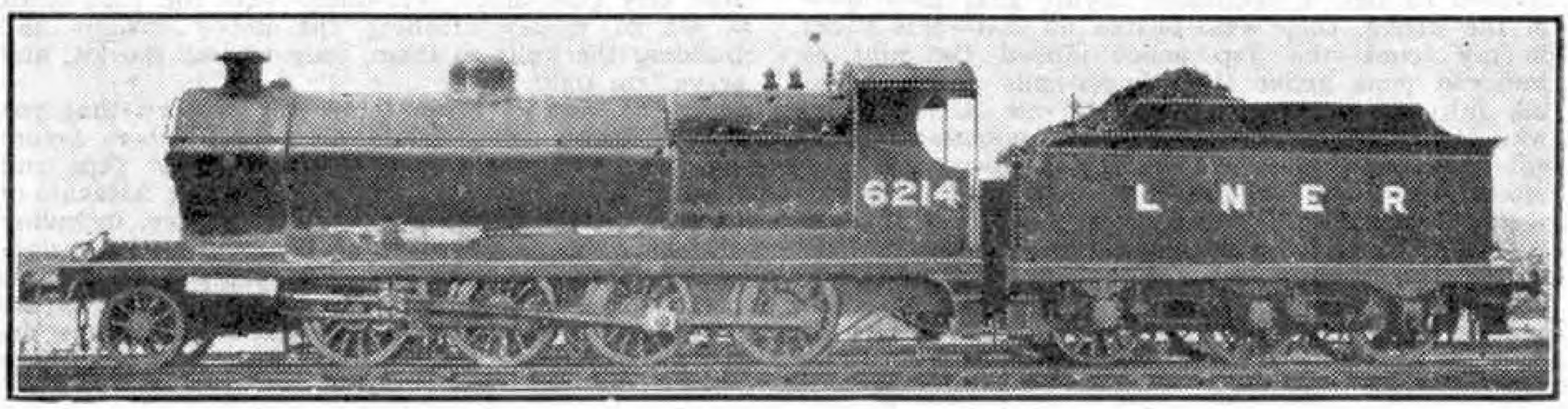
AN interesting locomotive conversion has been carried out on the L.N.E.R. with No. 6595, a 2–8–0 of Class "04." This class is a large one, including over 300 examples, and is of exceptional interest because of its history. During the Great War of 1914–18 locomotives were urgently required for war purposes. A 2–8–0 design originated by Mr. J. D. Robinson for the Great Central Railway, of which he was Chief Mechanical Engineer, was chosen as a standard type, and 521 engines of this design were built. After the war many of these were sold to British railways, and more than half the total found their way to the L.N.E.R.

The illustration at the foot of this page shows the original form of the class. In order to avoid perpetuating the boiler with which No. 6595 and other members of the class were then fitted, it has been given a new type pressed to 225 lb. per sq. in. instead of the 180 lb. per sq. in. of the former. The new boiler in fact is the same as that used in the locomotives of the "B1" "Antelope" 4–6–0 class, which was designed by Mr. E. Thompson, O.B.E., Chief Mechanical Engineer of the L.N.E.R., in 1942.

It will be seen that in making this change of boiler Mr. Thompson is following out his policy of locomotive standardisation. This applies also to further changes, notably in regard to the cylinders and motion. Here again the engine has been fitted with the same cylinders, of 20 in. dia. and 26 in. stroke, as those employed on the "Antelopes," with Walschaerts valve gear, piston valves and modernised steam distribution arrangements, and as many other details as possible also are made interchangeable with those of this class.

Some interesting comparisons may be made. The cylinders of No. 6595 before conversion were of 21 in. dia. and 26 in. stroke, while those of the re-built locomotive are 20 in. by 26 in. The grate area has been increased from 26¼ sq. ft. to almost 28 sq. ft. The superheating surface has been very largely increased, from 242 sq. ft. to 344 sq. ft. and the tractive effort at 85 per cent. boiler pressure is now 35,518 lb., an increase of 4,192 lb. over the 31,326 lb. of Class "04." The weight in working order is 73 tons 6 cwt., 2 cwt. more than that of the original locomotive.

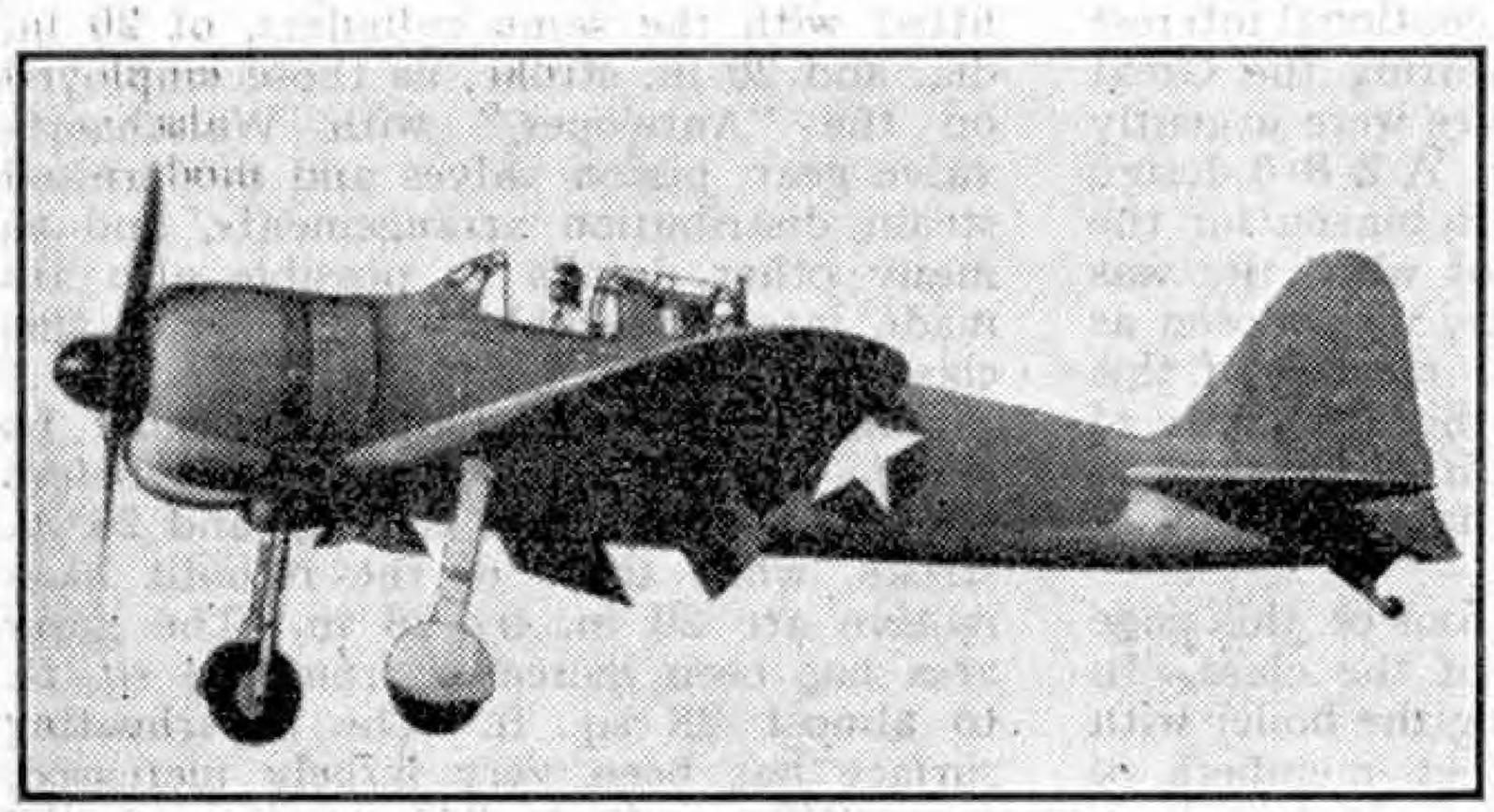
The converted engine has been given the classification "01," and to make room for the new class the locomotives formerly designated "01" are now classed "03."



How to Beat Japan

Obviously by Air, says C. G. Grey

JUST in case anybody may have the idea that when Germany has been defeated the war will be over, let me remind our readers that, apart from stopping wars between rival factions all over Europe, we still have to beat Japan, and that Japan will take a lot of beating. Years ago Rudyard Kipling pointed out, in writing of the fanatical Mahometon Pathans of the North-west Frontier of India, that a man who is certain that by being killed in battle he will open the Gates of Paradise for himself has an advantage from the start over a man who has a lingering feeling in favour of remaining alive. The Japanese are worse than that. Apart from any Buddhist or Shintoist idea of going straight to Heaven, the Japanese, in common with a good many other Oriental peoples, do not much mind being killed. They commit suicide with very little provocation. In this war, besides dying as a matter of duty in battle, they commit suicide because of fear of being taken prisoner. That is not a matter of military honour, but because they are afraid that their enemies, whether British, U.S.A., Chinese, Dutch, or Malay, will treat them as they themselves would treat prisoners.



Captured Japanese "Zero" Fighter, bearing U.S. markings.

There are ingeniously cruel people in all countries, but for wanton cruelty the Japanese probably beat any other nation. They combine ingenuity and callousness to a remarkable degree.

Only a few years before this war four sailors of the King's Navy were on shore leave for a few hours from a British cruiser in a small port in the Japanese island of Formosa—where, incidentally the Japanese had committed appalling atrocities on the natives when they conquered them a few years before. Our King's men had a slight row with a cab-driver and were arrested by the Japanese police. When they refused to sign a document saying that they were in the wrong, they were beaten up and—this sticks in my mind—the Jap police jabbed the nibs of fountain pens under their finger-nails and squirted ink into the punctures. One of our R.N. officers who heard of the row went to the police-station to get them out, and was himself thrown out with violence.

Eventually the men were got away, I forget how, and our Government of that day never even had an apology or compensation for the men. In an earlier and sterner age—even 50 or 60 years earlier—the captain of the ship would have blown the town into its own harbour and have chanced the consequences.

Also the Japanese are the biggest crooks and the clumsiest spies in business. More than 45 years ago, when I was a draughtsman in Coventry, a Jap came over with the finest commercial and financial credentials and started a deal with the Centaur Cycle Co. Ltd.—since, I believe, deceased—which made very good bicycles which were full of patented gadgets. He bought a couple of samples of each type, paid for them, and shipped them to Japan. The makers were delighted to give him their agency for the Far East on generous terms.

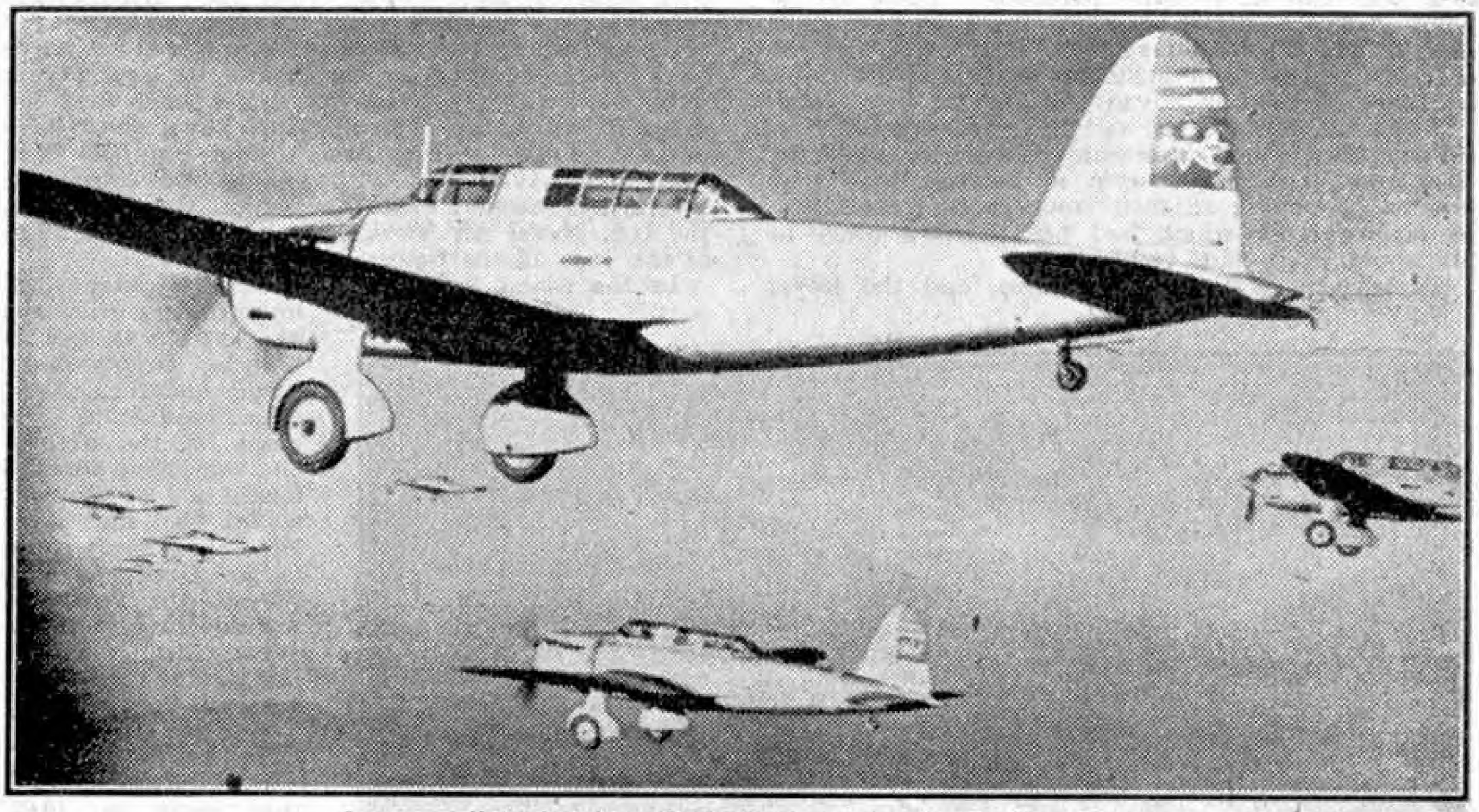
Some months later came a letter demanding much more generous terms; so generous in fact that there would have been no profit for the makers. With that came a statement that the Jap had taken out Japanese patents in his own name for all the Centaur's patentable gadgets, and pointing out that if they refused his demands they could not appoint any other agent, or open a depot themselves, because if they did they would be infringing his patents. The nerve of the little beast! So the Centaur Co. told him to do what he liked; they would do without Japanese business.

There is a grand story of a famous English shipbuilding company which was asked to tender for three cruisers for the Japanese Navy. The Japs wanted complete detailed drawings, to be inspected and checked by their Naval engineers; and, as there was a chance that the Japs meant to play straight, a set of drawings was sent, after some months spent in preparing them. A year or so later the drawings came back with many regrets that the price of the ships was too high.

Something more than a year afterwards, we heard in this country that Japanese shipyards had launched two cruisers of the same class as that for which the English firm had tendered. And, an amazing thing, both of them had capsized when they took the water. You see what had happened? Our designers, having suspicions that the Japs only wanted the designs so that they might copy them, had deliberately designed the hull so that it *would* capsize. And the Jap naval architects did not, in those days, know enough to spot the error in design.

Everything else such as interior arrangements, scantlings of beams and girders, thickness of plating and so forth, was perfect. And if the Japs had played straight, and had ordered the ships, our designers would have altered the design of the hull without the Jap "experts" noticing it, and they would have had very good ships. As things were the Japs spent a lot of money cribbing the decoy designs and building the hulls to them, only to lose the lot, and serve 'em right.

In the aircraft trade there was a story that one of the firms which made our big bombers before this war gave a party to baptise a new type and invited to it all the Navy, Army and Air Attachés of foreign nations represented in this country, including of course, the German, Japanese, Italian, Hungarian, Russian, U.S.A. and whatnot—prospective friends and foes alike. The prototype machine, that is the first one turned out, was all jacked up so that the under-carriage retracted and extracted, and the



Japanese light bombers flying in formation in the Far East.

bomb-doors opened and closed and so on.

After all this had been demonstrated the guests moved on for refreshments. Presently one of our Air Ministry high-ups said to the boss of the firm that he wanted to have another look at the machine. So they went back to the deserted assembly-shop, where the boss man climbed into the cockpit and the Air Ministry man stood on the floor and asked him to show how the bomb-doors worked.

The boss pressed the button, the bomb-doors opened, and out of them, to the feet of the Air Marshal, rolled the Japanese Air Attaché, sketch-book in hand! He was so flustered that he never stayed to apologise or explain. He just ran—so the story says!

The Japs are not really clever, they are merely twisters, and in many ways they are entirely stupid, because they think that intelligent people will be taken in by their low cunning.

Now those are the people whom we have to lick, and we shall have to lick them hard to keep them from rising again to be a menace to the peace of the Pacific Ocean. Primarily the job concerns the United States more than us, because they have more sea-coast on the Pacific. But as the Japs are a menace to Australia, New Zealand, Malaya, Burma, and even to India and Africa if allowed to run wild, we have at least as much commercial interest in smashing them for good and all. The question is how? The answer is obviously—by Air Power.

The Japanese showed us, by sinking the "*Prince of Wales*" and the "*Renown*," that Sea Power without air cover is helpless against land-based Air Power. So the U.S.A. and ourselves will have to show them that land-based Air Power can be beaten by sea-borne Air Power.

The greatest danger is that the great vested interests of the Navies and Armies of the Allies will insist that the Navies shall push the Japs up from the South, island by island and atoll by atoll, while the Armies push them down from the north, through Burma and Malaya tree by tree through the jungles. They may neglect the obvious fact that air attack on Japan itself would stop the war in a few months, just as burning out a wasp's nest leaves all the wasps who are away from the nest out in the open without a home.

We could only get at Japan by air from land bases in Siberian Russia or in China. Russia is not at war with Japan, and is not likely to be, so we can wash out Siberian airfields. And we are not likely to get at airfields in China for a year or two ahead, after we have cleared the Japs out of Burma and Malaya and have become able to supply China by sea.

A dozen Burma Roads or railways could not send into China enough war material to beat Japan from the air, and the idea of flying enough supplies from India "over the Hump" as they call it, that is over the Eastern end of the Himalayas, is just silly. The Russo-American Severski, of the Walt Disney film, may say that it can be done—his imagination works that way. But General "Uncle Joe" Stilwell, of the U.S.-Chinese Army knows better and says so. And I fully agree with him. We can only attack Japan from shore-based airfields if and when we have command of the sea. And by present methods we shall have to wait years to get that much.

When once we can get at Japan from the air the rest will be easy. The Japanese, on an average are poor pilots, and their aircraft are poor also. I was heavily abused in various papers for saying so when the Japs bombed Pearl Harbour, and still more when they captured Singapore and Malaya and Burma and the Dutch West Indies.

But when we discovered that at no time could the R.A.F. put as many as a dozen "Hurricanes" of the earliest type into the air at Singapore, people began to understand why we were beaten. Those wretched machines were flown and flown till they were simply worn out, but old-fashioned as they were they could still beat anything that the Japanese put up against them.

Nevertheless Singapore was not lost altogether by lack of aircraft as history will tell in due course.

In all this jungle fighting in Northern Burma aircraft are necessary, but they cannot blast a way for the Army as the R.A.F. did in North Africa, or as the Luftwaffe did in Poland and in France. They can bomb transport by rail or river, or by road when there are any roads, but they cannot do much against troops hidden by trees. They can give top cover against Japanese bombers and fighters and act as supply droppers to detachments in the jungle. But I can see no very spectacular future for the R.A.F. in the South-East Asia war, apart from towing gliders and dropping parachutes.

The U.S. Army Air Force can only do the same sort of thing, plus carting supplies, in penny numbers, "over the Hump" to China.

At present the spectacular jobs are being done in the South Pacific—or at any rate we hear more about them. Island-hopping, as the U.S. Air Force

over here call it, is quite profitable. There are so many groups of atolls on which the Japs have built airfields and supply-dumps that "task forces," as the U.S. Navy calls its detachments sent on special jobs, can have all sorts of adventures and be very useful.

When the war started and the Japs collared New Guinea they came unpleasantly close to Australia. The Australian people were so anxious that they insisted on having all their troops back from Africa, to replace those which had been thrown away at Singapore. And quite right too.

Those men, and new formations, and the Royal Australian Air Force soon had the Japs bottled up on North New Guinea. By curious coincidence much of the heaviest fighting was round Lae and Salamaua, whence, 20 years ago, one of the first profitable air transport services started flying goods and passengers up to the Bulolo goldfields, a journey that took 25 to 35 minutes by air and three weeks by jungle track.

Much in the same way troops used to march for 10 or 14 days from Fort Moresby over the Owen Stanley range to the fighting area on the North Coast, fall sick or be wounded and fly back in an air ambulance in half an hour.

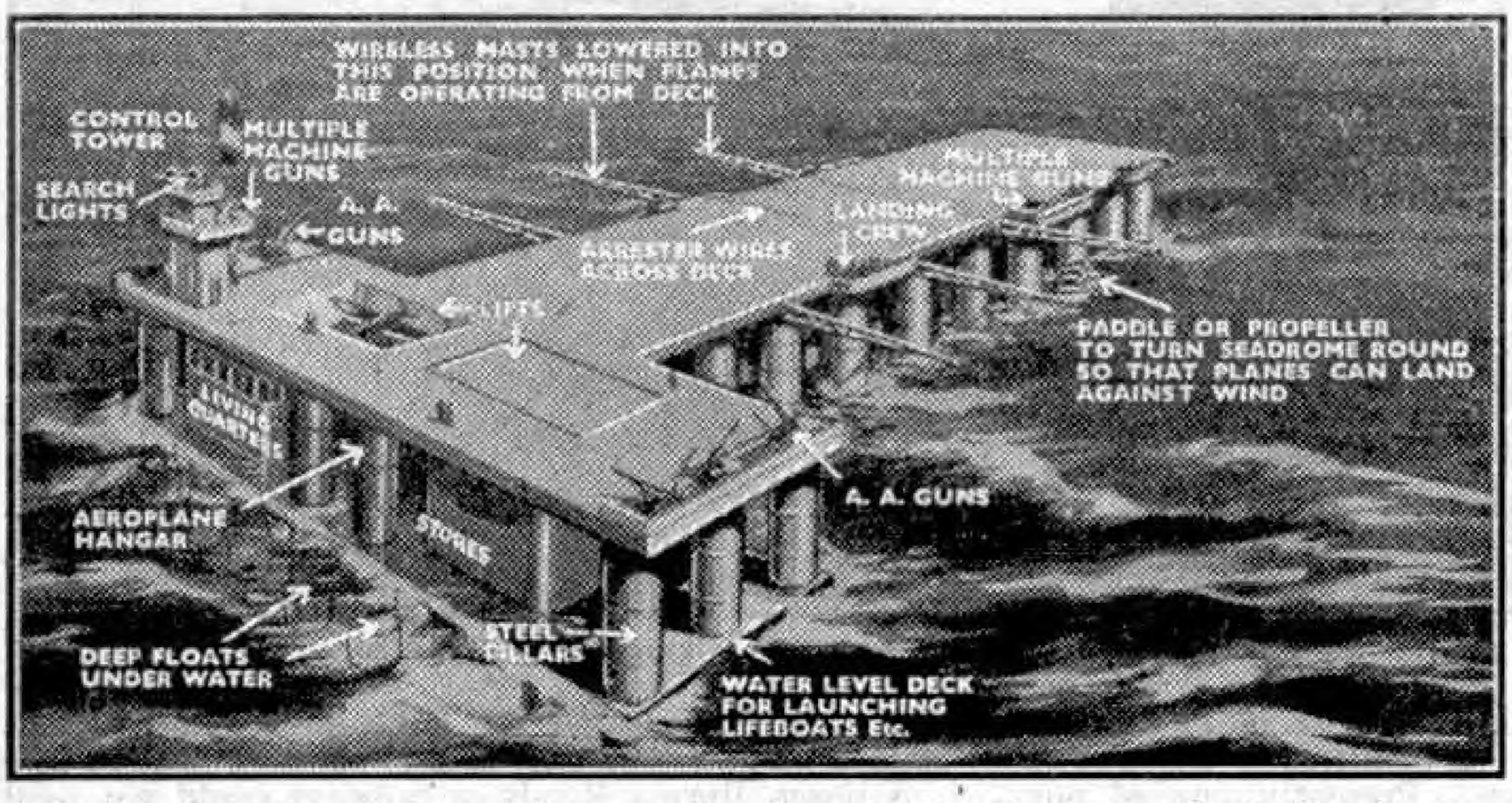
Now an interesting point here is that all through 1942, after the U.S.A. Forces had been driven out of the Philippines and the Dutch East Indies, and new troops had been sent to Australia, the U.S.A. Air Forces were always on top of the Japs, although their aircraft were admittedly inferior to those fighting in Europe and Africa, just because they were of older types, and unfit for first-class air war. "Mohawk" and "Kittihawk" fighters and early models of "Lightnings" shot down Japanese "Zeros" by the dozen and lost very few themselves.

After about a year we sent a batch of "Spitfires" to Port Darwin, at the North West tip of Australia, where Jap bombers from Timor had been rather a nuisance two or three times. The Royal Australian Air Force pilots, from Europe, who took them over, lay in wait for the next Jap raid. About 30 Japs came over. A dozen "Spitfires" went up, and no Japs went home. The officers at their base must have wondered what had happened.

A very similar thing happened at the Eastern tip of New Guinea. A detachment of Jap infantry landed, expecting to walk peacefully into Port Moresby. They came along laughing and singing "like a lot of school kids," as an Australian friend of mine said, and walked into what he called "a machine gunner's dream." The Aussies laid out the lot. On an officer they found orders to occupy a small airfield near by and hold it ready for the arrival of a formation of "Zeros" at a certain hour next day. Before that hour a formation of "Kittihawks" went up and sat aloft till they saw the Japs circling round to land, with undercarriages down. Then the "Kittihawks" dived, and no Japanese came up again.

Since then, vastly re-inforced U.S. Naval air forces have been operating in the South Pacific. Flying from carriers, they have won quite important sea fights in which the U.S. and Jap Naval ships have never seen one another. And, to give the Japs their due, they have sunk, with bombs and torpedoes, several U.S. carriers and big warships. But, all round, the U.S. Naval Air Service has had the upper hand of the Japs all the time.

In the island fighting the U.S.N.A.S. have sunk uncounted numbers of Jap transports, tankers, supply-ships, barges and such. They have hammered Jap bases on the islands, and they have steadily fought a way through where the big ships and supply craft could follow. Gradually U.S. Naval Air Power is working up towards Japan itself and is threatening the supply-lines of the Japanese forces in the East Indies.



Artist's impression of a seadrome on the lines developed by Mr. F G. Creed. Reproduced by courtesy of "The Sphere."

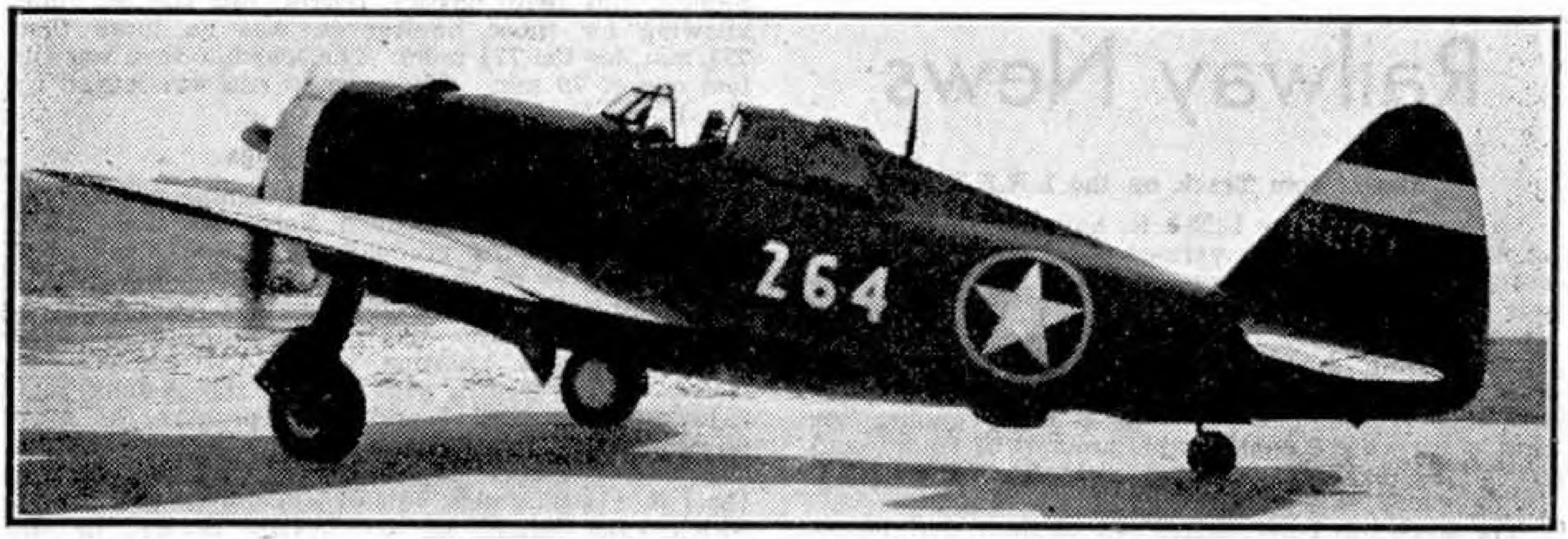
Remember, here, that early in 1942, Brig. General James Doolittle, now commanding the U.S. Army's 8th Air Force in England for the Great Invasion, took about a dozen twin engined light bombers on board a U.S.N. aircraft carrier, and flew them thence across Japan, dropping smallish bombs on Tokyo and other cities. Most of his crew reached China and safety. Some fell into the hands of the Japanese and, according to reports, were tortured and murdered. But that attack showed the way to the conquest of Japan.

To-day the U.S. Navy has carriers in large numbers. Some are as big as battleships, many are only converted merchant-ships with flat tops, as the U.S. airmen call them, built over them. These little "Woolworth carriers," as our R.A.F. call them, are not pleasant places in which to live or from which or on to which to fly. But they work.

With enough such carriers to cover one another against attacks by shore-based aircraft, the U.S. Navy could bring enough seaborne aircraft within range of the coastal cities of Japan to hammer them to pieces. Also, with enough such craft we could cut the Japanese supply lines to Malaya and Burma, and free the way for our supply ships to China.

Japan has no great command of raw material such as the Allies have, so the sinking of ships and destruction of aircraft is far worse for them than for us. Without supplies from Japan, the armies in China, Burma, Malaya and the Philippines and the Dutch East Indies would soon have to stop fighting. So, in the end, the answer to the Pacific problem is the building of enough carriers.

Besides carrier-ships of ordinary types there are, I feel sure, possibilities in seadromes, a kind of cross between a ship and a runaway seaside pier, about which there has been much argument for the past twenty years. The advocates of seadromes are now hard at work again here and in the States, and they have got to the stage when high Naval Authorities admit that they can find no theoretical, tactical, strategical or practical disadvantage about seadromes, except that there is no time to develop them for this war. So I suppose we shall have them for the next war. But I put on record my belief that we could if we tried, here and in the States, have enough seadromes ready by the end of this year to sink Japan by the end of 1945.



Photograph "Flight" Copyright.

The Republic "Thunderbolt"

By J. W. R. Taylor

TO the Republic "Thunderbolt" goes the honour of being the first U.S.A.A.F. fighter to operate against the Luftwaffe from Britain. That was in mid-1943, and to-day the "Thunderbolt" is still in the forefront of the assault on Hitler's Europe, although it has since been joined by the "Lightning" and "Mustang."

It was the first new American fighter to come into service since the outbreak of war, and its designers took full advantage of all the lessons taught by the great air battles of 1940-41, incorporating self-sealing fuel tanks, a sliding hood, radio, oxygen, and armour plate. In addition the "Thunderbolt" killed once and for all the old American bogy of "performance versus fire-power." The lack of a really powerful engine in 1939 prevented American fighters from combining high performance with heavy fire-power, but the 2,000 h.p., 18-cylinder Pratt and Whitney "Double-Wasp" installed in the "Thunderbolt" opened up new possibilities. For the first time for many years the American industry was able to produce a fighter aeroplane comparable in every way with contemporary European equipment.

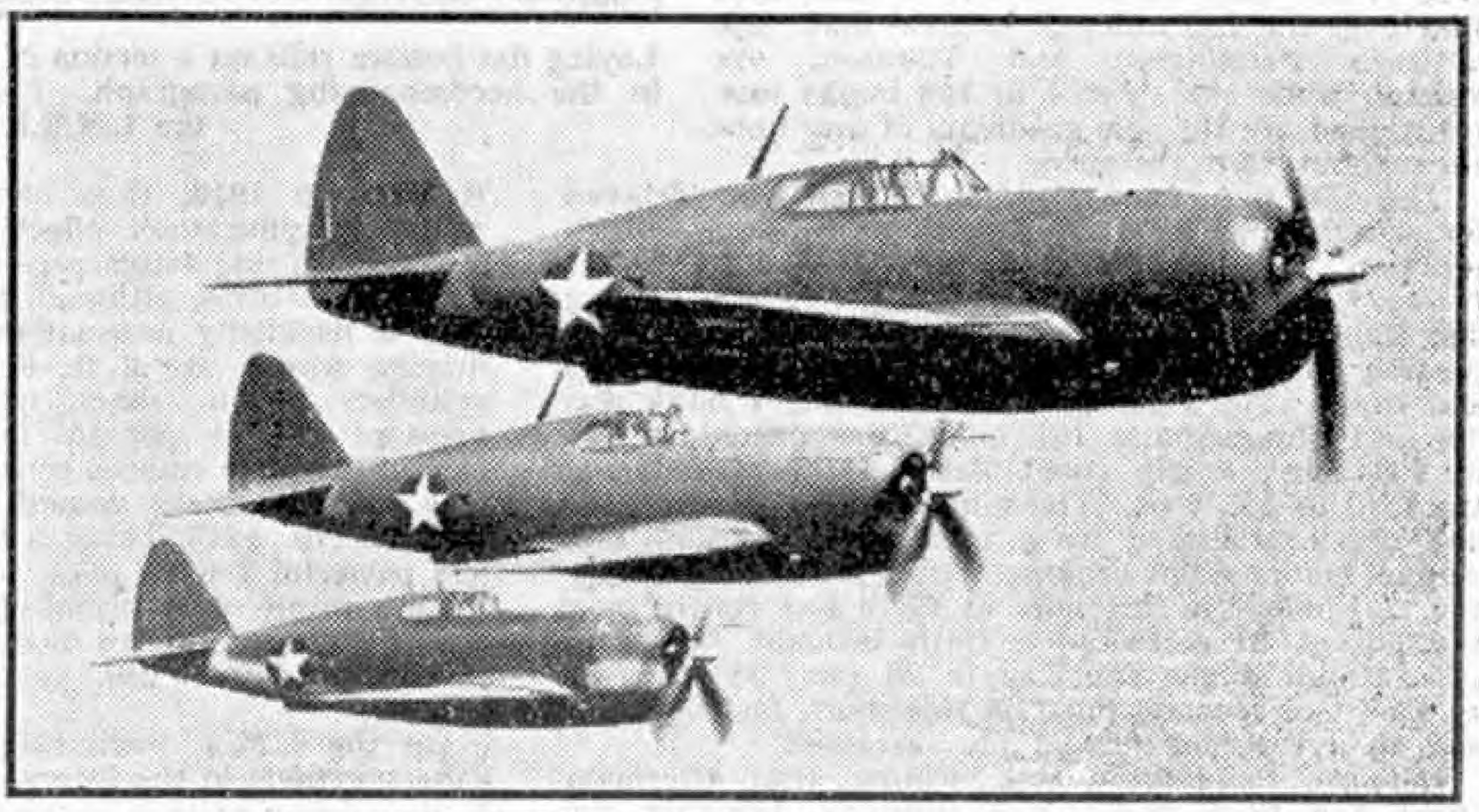
The "Thunderbolt" was designed by Alexander Kartveli, a Russian, in 1940, and the prototype—XP-47—flew on 6th May, 1941, only eight months after the contract for it was signed. It is a single-seat, all-metal, low wing cantilever monoplane, and has been described by one test pilot as "a snub-nosed powerful-looking brute." It certainly lacks the slim lines of the "Spitfire" and Focke-Wulf 190, but armed with eight·50 in. machine-guns, it has a fire-power of 773 lb. a minute, compared with the 650 lb. of the "Typhoon" and the 606 lb. of the Fw. 190.

This great power and punch could not be achieved without pushing up the weight to an unpleasant extent; indeed the "Thunderbolt's" weight of 6½ tons makes it the heaviest single-engined fighter in service with any air force. Kartveli had to face up to the risk that his P-47 might prove too big and powerful for one man to handle, but, as he says: "If we are not taking risks then we are still building biplanes." The "Thunderbolt" did not let him down, and to-day it is one of the world's most successful fighters.

Its top speed is in the region of 400 m.p.h., although official figures have not been released; and the installation of a turbo-supercharger—a feature not yet incorporated on British or German types—makes it admirably suited for escorting high-flying "Fortresses" deep into Germany, as it develops its full power at a height where the performance of the Fw 190 drops off rapidly.

In addition the "Thunderbolt" has a very long range, by reason of a 150 gallon drop tank that can be slung under its fuselage. This tank can be replaced by a 500 lb. or 1,000 lb. bomb for fighter-bombing duties.

Lt. Compstock of the U.S.A.A.F., while practising aerobatics in a "Thunderbolt" at 30,000 ft., put his aircraft into a vertical power-dive for 10,000 ft. The actual speed reached in this dive is not known, but it has been calculated that the airspeed indicator broke at about 728 m.p.h. This is but an isolated instance of the "Thunderbolt's" capabilities and does not prove much by itself; but scores of Focke-Wulfs falling in flames out of the German skies bear testimony to the superior speed, manœuvrability and hitting power of this American contribution to air supremacy.



A trio of "Thunderbolts" flying in formation.

Railway News

Flat-bottom Track on the L.N.E.R.

In recent years the L.N.E.R. have laid in stretches of flat-bottom rails on various parts of their system, with a view to providing a stronger track for post-war requirements. Early this year the company went a decided step further, and at a station a short distance from London a 1 in 10 lead or connection has been laid in, fabricated from flat-bottom rails weighing 110 lb. per yd. This is in a running line that is carrying a considerable amount of traffic, and the trial appears to be fully justified, as the lead is giving every satisfaction.

The work has been carried out to the requirements of the Chief Engineer's Department, L.N.E.R., in collaboration with Messrs. Taylor Bros. of Sandiacre, Nottingham, who manufactured the various parts at their works. Before despatch the work was fitted up complete with all the necessary crossing timbers, as is now customary, to ensure that there would be no difficulty in laying in the lead.

The actual work was duly carried out on a Sunday without any serious intereference with traffic, and everything fitted "according to plan." The accompanying photograph shows the work in progress. Arrangements for the installation of further switch and crossing work of this type are in hand.

A Fast Swindon - Bath Run

During the year immediately preceding the present war the fast start-to stop timing of 30 min. for the 29½ miles between Swindon and Bath, average 59 m.p.h., was given only to the early morning newspaper train from Paddington to Bristol and beyond. Some 12 years ago this booking applied to the 4.30 p.m. West of England dining car express from London, which later left at 5.5 non-stop to Bath.

From Swindon the line is gently falling for 8¾ miles to mile-post 86, where a 1 in 100 drop begins and continues for about 1½ miles to Dauntsey. The slight gradients on to Corsham mile-post 99 consist of 4½ miles down and then 7 miles up at 1 in 660, leading to the two-mile descent, mostly at 1 in 100, through the famous Box Tunnel, which is 1 mile 1,452 yds. long. The line is then almost level into Bath. Incidentally Box is the only tunnel of any considerable length in the 163 miles of original main line between Paddington and Taunton, via Bristol, while the short 1 in 100 banks just mentioned are the sole gradients of any note throughout that distance.

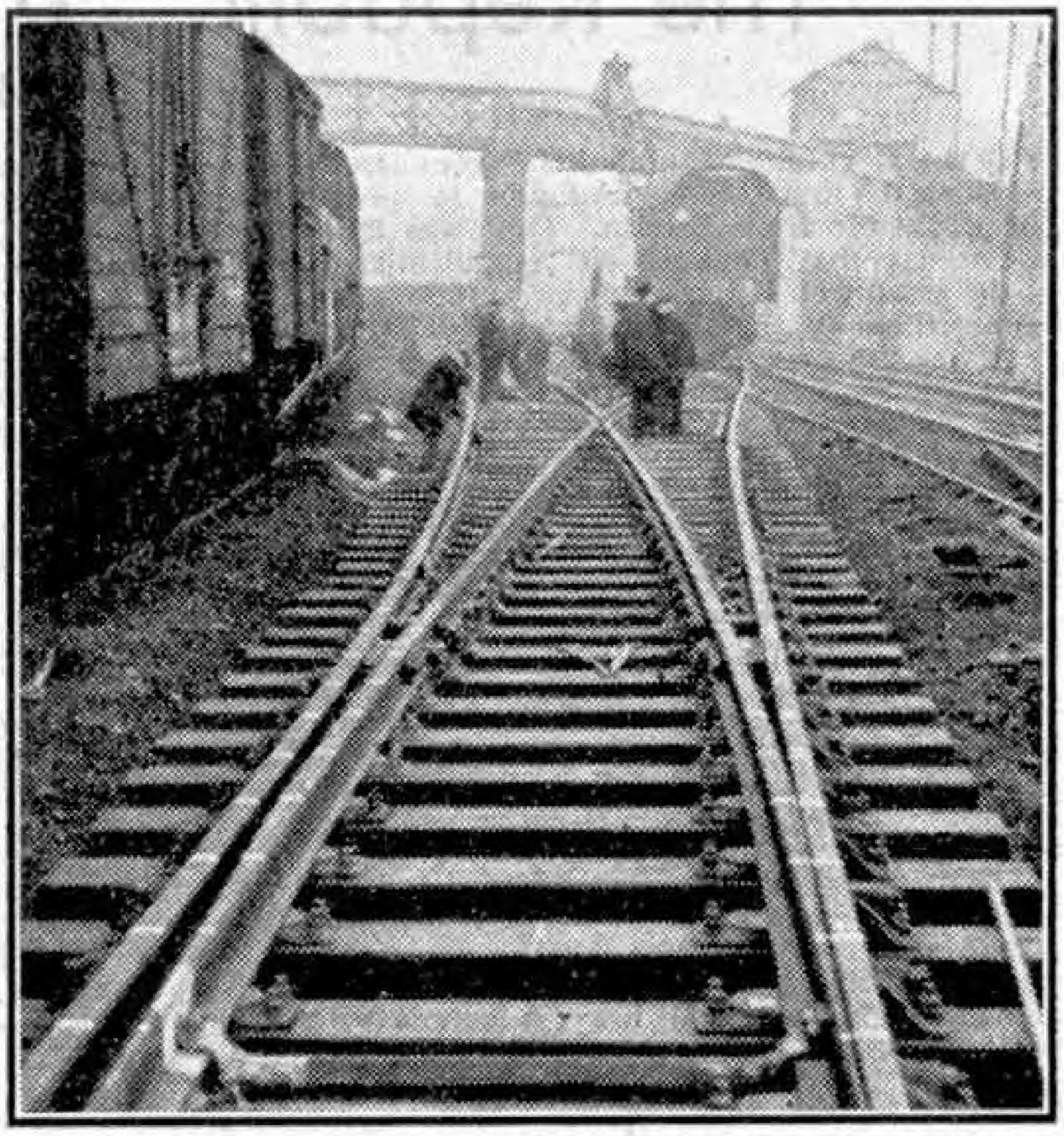
The 4.30 p.m. from Paddington had been delayed by signals, and by station work at Swindon, which junction was left 10 min. late. No. 6028 "*King Henry II*," later renamed "*King George VI*," was hauling 380 tons and was up to the mile-a-minute rate when passing Wootton Bassett, after which acceleration was rapid. The maximum down Dauntsey bank was 79, and Chippenham, 16¾ miles, was passed at 71½ in 16¾ min., a slip coach detached there reducing the load to 355 tons. The minimum at Corsham was 64½ m.p.h., followed by a maximum of 76 in Box Tunnel before slight braking. After passing Bathampton, 27¼ miles, in 25¾ min. at 67, a fast run in over the curves to picturesque Bath brought the train to a stand at the spa city in 28 min. 35 secs., so 1½ min. had been regained on this short, fast booking, and an average of 62.1 m.p.h. sustained.

Between Paddington and Swindon that afternoon there had been bad signal slowings, bringing the express almost to a stop at Dolphin Box, east of Slough, and again outside Didcot; but the net time, allowing for those hindrances, was no more than 77¼ min. for the 77¼ miles. The schedule then was the fast one of 79 min. This spirited run was logged by Mr. R. A. H. Weight.

Great Western Tidings

"Castles" and "Kings" are still coming from works painted green with modified finish, as now usual; all other classes are gradually becoming black. No. 6960, the first of the altered "Hall" 4-6-0s, is in traffic and we hope to be able to publish details shortly. Stafford Road Works, Wolverhampton, are still busy overhauling and painting engines of the smaller classes hailing from a wide area of the system.

Locomotives Nos. 7 and 8 are perhaps the most unorthodox engines built at Swindon in recent years. They are miniature 2-6-2Ts turned out in 1923 for the 1 ft. 11½ in. gauge Vale of Rheidol scenic railway, which runs inland up to Devil's Bridge, in the mountains, from Aberystwyth on the Welsh coast. This little line is very popular with tourists in normal times. It had been absorbed by the former Cambrian Railway in 1913, thus becoming G.W.R. property when grouping took effect in 1923. Nos. 7–8 are low-pitched side tanks presenting some typical Great Western features, although their outside Walschaerts gear is decidedly unusual in Swindon practice. The driving wheels are 2 ft. 6 in. in diameter; outside cylinders 11½ in. diam. with 17 in. stroke; boiler pressure 165 lb. per sq. in., total weight 25 tons. One of the little engines constructed for this line when new and privately owned is still in existence as G.W.R. No. 1213, being a somewhat similar though less powerful 2-6-2 tank.



Laying flat-bottom rails on a section of the L.N.E.R. as explained in the accompanying paragraph. Photograph by courtesy of the L.N.E.R.

As a result of a special effort, 28,659 wagons were recently cleared in two days and thus made available for further urgent use.

* * * *

On the L.M.S. worn rails are now resurfaced by expert welders in the intervals between the passage of trains. Frequently a section of rail can be repaired nine times before it has to be replaced.

A locomotive of the Surrey Border and Camberley Railway, of 10¼ in. gauge. Photograph by J. Chettleburgh, London N.W.2.

An Ambitious Miniature Railway

One of the most ambitious miniature railways in this country is the Surrey Border and Camberley Railway situated between Frimley and Camberley. It is five miles in length and of 10¼ in. gauge, and is equipped with six splendid steam locomotives. The overall length of engine and tender is 10 ft. and weight in working order 2¼ tons. Each locomotive is capable of drawing from six to ten carriages, carrying about 80 people and travelling at approximately 40 m.p.h. There are four stations and a double tracked line running through picturesque woods and meadow scenery alongside a river.

The railway ceased operation on the outbreak of war, prior to which a regular timetable was operated, with trains every 10 min. from 10.30 a.m. until 8.30 p.m. When it was open it was fascinating to watch on it the working of a railway in miniature. A particular attraction was that on weekdays visitors could arrange, for a small payment, to drive an engine themselves—truly the fulfilment of a boyhood dream for most of us.

J. CHETTLEBURGH, London N.W.2.

L.N.E.R. Locomotive Notes

No. 2577 "*Night Hawk*" is a further recent conversion from class "A1" to "A3/3." Streamlined "Pacific" No. 4466, which hitherto had been named "*Herring Gull*," now carries the nameplates "*Sir Ralph Wedgewood*" that were on No. 4469 of the same class until that engine was withdrawn from service on account of damage by enemy action.

Of the new "B1" 2-cyl. 4-6-0 type, No. 8303 "*Impala*" is reported to have done well when tried over the heavy gradients of the Waverley route between Carlisle and Edinburgh, and those of the West Highland line between Glasgow and Fort William; No. 8304 "*Gazelle*" and No. 8305 "*Oryx*" have been working G.E. section expresses, while the next one, No. 8306, is named "*Bongo*" after another member of the antelope family.

It is a far cry from the comparatively light high-speed expresses for which the "A4" streamlined design was originally introduced in 1935 to the 600–700 tons main-line passenger trains of to-day. To enable these remarkable locomotives to start such enormous loads more effectively, the maximum valve cut-off is being increased from 65 to 75 per cent. of the piston stroke. Engines so altered include Nos. 4466/7, 4487, 4499.

We heard recently of a "J62" type 0–6–0 outside cylinder saddle tank, No. 5885, that was still carrying its original date plates reading "M.S. & L.R. Gorton Works, 1897," although the Manchester, Sheffield and Lincolnshire Railway became the Great Central in 1899, the latter concern in turn being merged into the L.N.E.R. in 1923. There were 12 little locomotives of that shunting class, but only four are now left. "N2" type non-condensing 0–6–2 passenger tank of the Gresley "Great Northern" class, numbered 897, was built at Doncaster in 1925 and began work in Scotland. It has since operated on the G.E. and G.N. London suburban routes and now has travelled again to Neasden shed, whence it runs on the outer suburban passenger turns from Marylebone over the respective joint lines worked by the L.N.E.R. with the G.W. and Met. (L.P.T.B.) companies.

There are now over 180 powerful "V2" 2–6–2 engines at work; Nos. 3690–1 are shedded at York. It is understood that the last of the series will be numbered 3694, and the numbers will then be 3641–94 and 4771–4899.

Engines lately withdrawn for scrapping include No. 822 of the former N.E. "B15" 4–6–0 mixed traffic class, with 5 ft. 6 in. diam. boiler, 6 ft. 1 in. driving wheels and two outside cylinders, built 1911–3; "C7" N.E. 3-cyl. "Atlantics" Nos. 714 and 2209; "C1" G.N. 4–4–2 No. 4430, which has always been stationed at Peterborough or Grantham, sheds that are included in the same district, except for a spell on the Cambridge-King's Cross buffet-car expresses; and No. 6095 of the "B4" two-cyl. Great Central 4–6–0 "Immingham" series, which had been condemned before but was reprieved on account of wartime traffic pressure. No. 6095 is the first of her class to go. No. 8039 is now the sole survivor of the "D13" rebuilt Great Eastern 4–4–0s, as No. 8023 has been withdrawn.

It is understood that all 54 "B12" G.E. 4–6–0s at work on that section, except one, No. 8534, have now been rebuilt with Gresley round-top boilers, raised framing and improved valve gear. The other un-rebuilt ones are in Scotland. Somewhat similar new boilers with round-top fire-boxes have been fitted to Nos. 8273, 8283 and 8292–3, of Class "J20."

A G.W.R. "King" at the head of a stopping train, after works overhaul. Photograph by G. O. P. Pearce.

Have You Ever Thought About This?

Why Steam is Superheated?

NOWADAYS most locomotives are so designed that the steam supplied to their cylinders is superheated, that is to say it is given heat over and above that acquired by simply boiling the water in the boiler. Now why is the steam given this additional heat? There are many reasons, but the basis of most of them is that the practice is economical.

Let us see how this comes about. If water is boiled in a kettle, the steam has the temperature of the boiling water, that is 212 deg. F. In a locomotive boiler the pressure is greater than that of the atmosphere, and the temperature of the steam is correspondingly higher. Steam in a boiler at 100 lb. per sq. in. pressure, that is at a pressure 100 lb. per sq. in. above that of the atmosphere, always has a temperature of 338 deg. F., while raising the pressure shown on the gauge to 200 lb. per sq. in. increases the temperature to 388 deg. F. This is called saturated steam, and it has the disadvantage that cooling it causes condensation to begin immediately. For instance, when the steam from a non-superheated locomotive boiler enters the cylinders it meets metal at a lower temperature than itself, and its pressure is reduced because some of the steam is condensed. To enable the locomotive to do its proper work more steam therefore has to be added to compensate for the loss due to condensation.

Steam Hotted-Up To Dry It

Now the best way to avoid this loss is to make the steam hotter, and this is the idea of superheating. After leaving the boiler, and before passing on to the cylinders, the steam is given more heat, and the result is that it can be cooled to a certain extent, in the steam pipes and in the cylinders, without condensation taking place, the extent depending on the degree of superheat.

Saturated steam always has in it a certain proportion of water in suspension. That is to say it is not perfectly dry, and with some boilers the amount of moisture carried over in the steam is quite large. This moisture represents a direct loss of heat, as it is at the same temperature as the steam, but is of no use as far as the work of the locomotive is concerned, and all the firing-up that has gone to make it hot is therefore wasted. Moreover, the wetter the steam the quicker the condensation, because heat is transferred to a moist surface more quickly than to a dry one, so that here again there are serious losses due to the steam not being dry. By superheating the steam these troubles are avoided. As the temperature is raised the steam becomes really dry, being transformed completely into real invisible steam instead of something more nearly resembling the cloud of so-called "steam" that issues from the spout of a kettle when its contents reach boiling point.

Old Engines Made Young Again

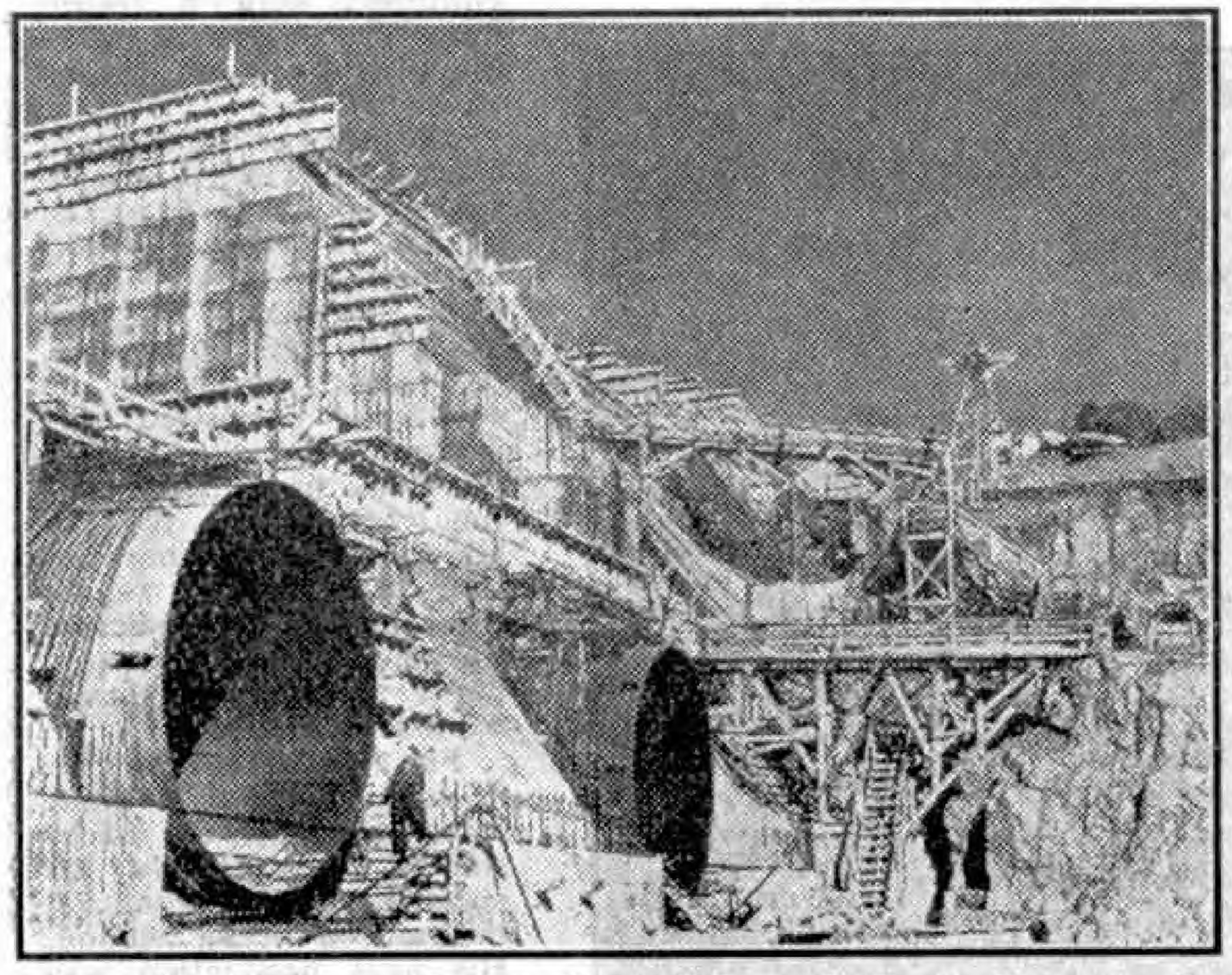
It will be seen that superheated steam is all working steam, so that the trouble and expense involved in boiling up the water in a superheated boiler is all productive. Thus superheating brings with it a saving in both fuel and water, and this enables locomotives to run longer distances without replenishing supplies. It does practically nothing to increase the starting power of an engine, but it does allow a larger horse-power output to be maintained, with an increase in haulage power when running. In many cases engines that have become obsolete as a result of the increase of train loads have been given a new lease of useful life by the addition of a superheater.

The idea of superheating is simple, but many types of superheater were tried before satisfactory results were obtained. To-day superheaters are of what is known as the "smoke-tube" type. In these, saturated steam from the boiler goes to a collector called a "header," which is connected to superheater tubes or "elements." Each of these consists of four runs of pipe placed in a large boiler tube, and connected together to form a continuous passage for the steam. There they are surrounded by the furnace gases. The steam in them passes four times backward and forward along the heated tubes before it returns to a separate compartment in the "header" and is carried on to the cylinders. There is a double advantage here, for the temperature of the steam is raised by heat that otherwise would be largely wasted up the chimney.

Engineering News

Tool Salvage in the Thames

It is only to be expected that hammers, spanners, crowbars and other tools will at times be dropped into rivers over which steel bridges are being erected, and of course nuts, bolts and even steel plates and slings also may find their way into the water. It is not easy to retrieve material lost in this manner, but a very efficient way of doing it has been devised by the contractors for the demolition of the old Waterloo Bridge and the construction of the new one. It takes the form of an electro-magnet 2 ft. 2 in. in diameter, designed and constructed by the General Electric Company. This is specially adapted for use under water, and has a lifting capacity for solid blocks of steel of 5 tons. The magnet was hung from the hook of a travelling jib crane that moved over the roadway of the new Waterloo Bridge, and a remarkably large quantity of bolts of all sizes, hammers and other materials of great value was recovered in this way. Systematic sweeping with the magnet from a small boat should be even more effective.



A construction scene during the building of Norris Dam, in the Tennessee Valley, in the United States, showing the ends of two huge penstocks, each 20 ft. in diameter. Through these tubes water stored behind the dam flows to the turbines driving the generators in the power house. In the background are two of the towers of the cableway system used for carrying the concrete of which the dam was built.

Chicago's New Subway

In spite of war conditions an extensive underground railway scheme begun in Chicago in 1938 has been completed. It was designed to supplement the elevated rapid transit railway, and is almost 5 miles in length. Its cost was over £8,000,000.

The tunnel consists throughout of twin tubes, each carrying one track, and it is remarkable for the variety of engineering methods employed in its construction. In some places, near the portals, open cuts were made and the tubes installed in them. In the central section the soil through which the tunnel had to pass was unsafe, and there shields were used of the same type as those employed in driving tunnels through silt and clay underneath rivers such as the Thames, and the Hudson at New York. Tunnelling, hand mining and other methods were used in other sections. Where a shield was used the twin bores are circular in section, and in other places they are horse-shoe shaped. The walls are all of reinforced concrete, except under the Chicago River, where twin steel tubes already built up were sunk into a deep trench excavated below stream level. The steel tubes are lined with concrete.

The tunnel is largely ventilated by the passage of the trains themselves, and there are special openings through which air is sucked in and pushed out. There is a sidewalk through the tunnel. This is placed at the height of the floors of the coaches, with exits at comparatively short intervals. Switches are installed in alarm boxes at intervals of 400 ft. so that current can be cut off over large sections in the event of an accident or other emergency.

The stations in the downtown section are of special interest. There are eight of them, covering a total distance of 3,430 ft., and a continuous platform between the two tracks connects them. The stations themselves are just below street level, with stair entrances on the pavements, and escalators take passengers to and from the trains in the tunnel below. Another striking feature is the use of different colours for the stations. The signs, pillars and walls of these are painted blue, red, green and brown in rotation so that they can be identified at a glance as the trains run in.

London's Underground Water

The level of the water in the strata below London is being steadily lowered, and is now from 200 ft. to 300 ft. below sea level. The reason for this is that it is being used up at a rate greater than the supply maintaining it. The area forms a vast basin, with cup-shaped water-bearing strata below a layer of clay. The water-bearing strata come to the surface around the edges of the basin, and it is there that the water enters them. When wells are bored through the clays the water rises. At one time it rose to the surface in many of them, but this has not been the case for many years.

Conveyor Belts for Building Giant Dams

The practice of using conveyor belts for carrying materials for dam building has been followed on several occasions in the United States, notably in constructing the Shasta Dam, in northern California, as described and illustrated in the "*M.M.*" for February, 1942. Now conveyor belts are to be used to provide the main haulage system in work of this kind to be carried out in building a dam across the Boise River, in Idaho.

The dam is to be of earth, and will be the highest of its kind in the world. It is estimated that 12,000,000 cu. yds. of clay and other soils will be needed, and most of this will be handled by belts with a total length of nearly 30,000 ft., or about 5½ miles. There will be nine flights of belting 36 in. in width to carry clay for the core of the dam from a pit a mile and a half away, and other materials will be dealt with by several 60 in. belts.

The capacity of conveyor belts for work of this kind is very large. It is estimated that by the end of 1943 the Shasta Dam conveyor already referred to, the total length of which is 9 miles, had delivered altogether almost 11½ million tons of aggregates for the making of concrete.

Timothy Hackworth

The Story of a Great Locomotive Engineer

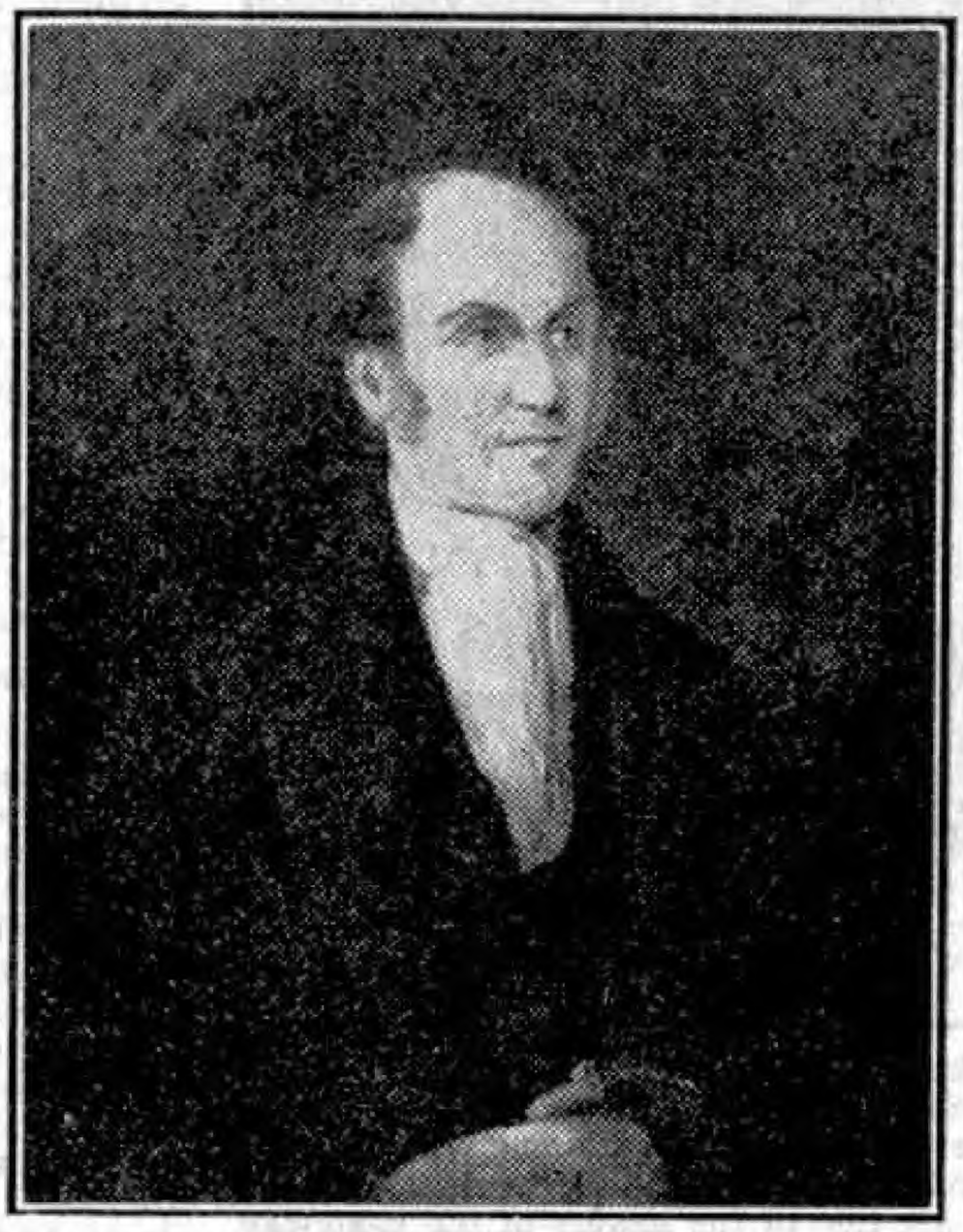
IN the "*M.M.*" for June, 1943, we gave an account of the part played by William Hedley in the development of the steam locomotive, and referred to the engine built at Wylam in 1813 by Hedley, Timothy Hackworth and Jonathan Fisher. Hackworth subsequently took an important share in establishing the steam locomotive as a practical means of haulage.

Timothy Hackworth was born at Wylam on 22nd December, 1786, his father being foreman blacksmith at Wylam Collieries. The boy served a seven years' apprenticeship under his father at the colliery, and on the completion of this was appointed foreman of the smiths. In 1816 he went to Walbottle Colliery as foreman smith and stayed there for eight years. In 1824 George Stephenson was appointed surveyor for the Liverpool and Manchester Railway, and Hackworth took over the temporary management of Stephenson's engine works at Newcastle. When Stephenson returned to Newcastle he offered Hackworth a permanent post with a share in the business, but for some unknown reason this offer was refused.

In June, 1825, Hackworth joined the Stockton and Darlington Railway Company as superintendent of the permanent and locomotive engines, some three months before the opening of the railway. He took an active part in the preparations for the great day, 27th September, 1825, and in the event itself. The operation of the railway in its early days was full of setbacks and difficulties, and Hackworth proved of the utmost value to the company during this period. The first engine, Stephenson's "*Locomotion No. 1*," had an exciting career, including the blowing up of its boiler, and it was rebuilt and to some extent redesigned three times by Hackworth. Three other engines followed from the works of Robert Stephenson and Company, and one from Robert Wilson of Newcastle, but troubles continued, and doubts began to be expressed as to whether locomotive traction would really be capable of superseding the horse. The company had seriously considered the abandonment of steam when Hackworth undertook to build an engine that should definitely fulfil all requirements. The result was the construction of the "*Royal George*," for which Hackworth used the boiler of Robert Wilson's engine, known as the "*Chittaprat*," which had been abandoned as a failure.

The "*Royal George*" was the first locomotive to have six coupled wheels. Among its other notable features was the blast pipe, by means of which the exhaust steam was discharged into the chimney, thus producing a draught that greatly improved combustion in the furnace. This engine ran successfully on the line from 1827 to 1840. A model of it, built by Hackworth, is now in the Science Museum, South Kensington. The success of the "*Royal George*" led to an order for another engine, and in 1829 Hackworth produced the "*Victory No. 8*," which also proved very successful.

When the Rainhill locomotive competition was announced Hackworth determined to build an engine to take part. The result was the "*Sanspareil*," an 0-4-0 engine with coupled wheels 4 ft. 6 in. in diameter. The vertical cylinders were 1 ft. 6 in. in length and 7 in. in diameter, and were placed in an inverted position above the trailing wheels. The boiler was 6 ft. long and 4 ft. 2 in. in diameter, and had the grate and chimney at the same end, being equipped with a return flue. The engine in working order weighed 4 tons 15 cwt. 2 qrs.



Timothy Hackworth. Photograph by courtesy of the Director of the Science Museum, South Kensington, London.

The story of the Rainhill contest, in which Stephenson's "*Rocket*" proved the winner, is too well known to need re-telling here. The "*Sanspareil*" was unfortunate. To begin with, its weight exceeded the 4½ tons permitted for 4-wheeled engines. It was therefore not eligible for the prize, but it was allowed to take part in the trials. Then came troubles due to defective workmanship, which caused boiler leakage and finally a burst cylinder.

The failure of the "*Sanspareil*" was a great disappointment to Hackworth, but it only increased his determination to build a better engine. His next production was the "*Globe*," among the notable features of which was a copper steam dome designed to produce "dry" steam. This engine hauled passenger trains on the Stockton and Darlington Railway successfully for over eight years, and it is claimed to have attained a speed of 50 m.p.h. Its career was ended by the explosion of its boiler.

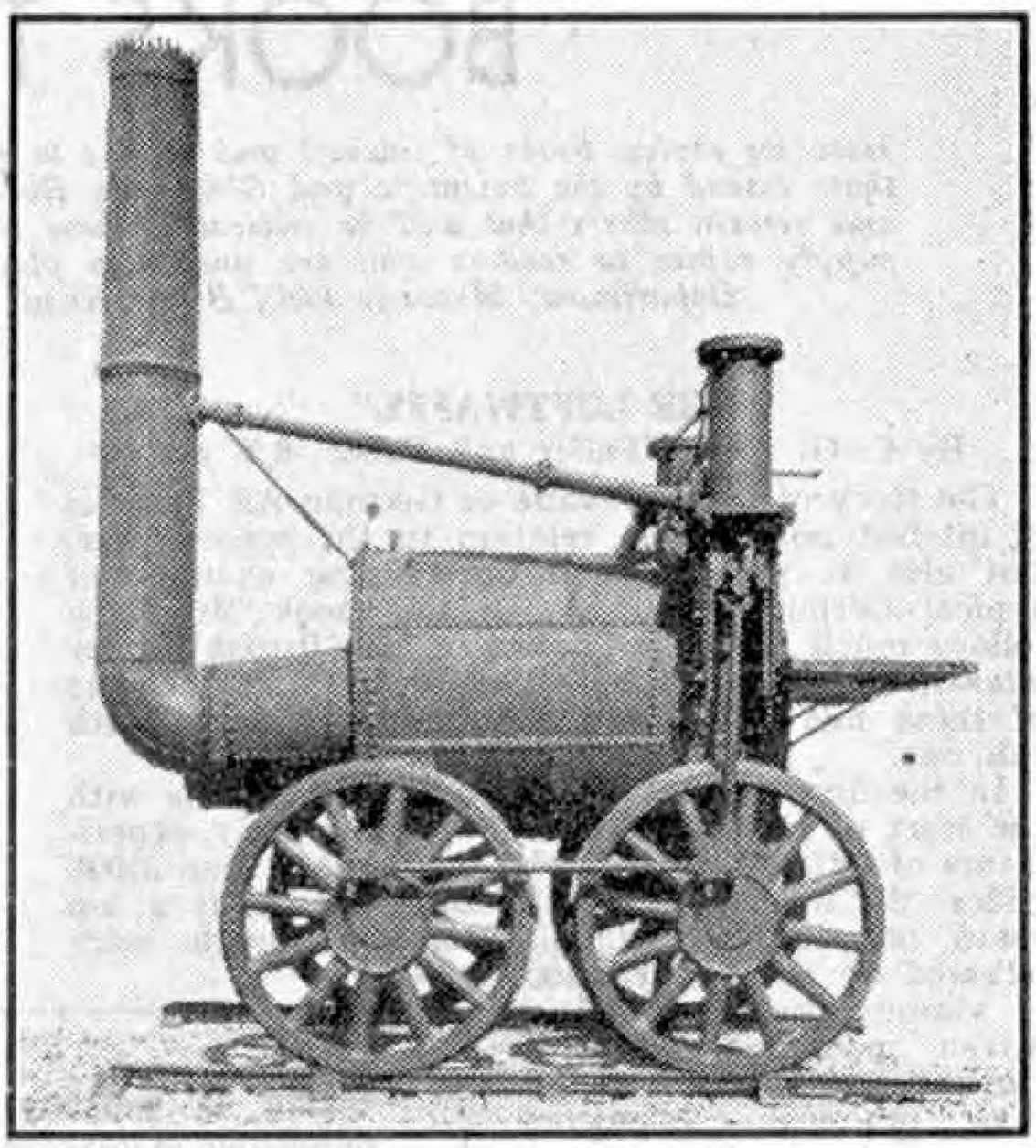
The "*Globe*" was followed by a number of engines designed for coal traffic, which proved very successful and greatly increased Hackworth's already high reputation. These Stockton and Darlington "colliers" were of a characteristic design which, with modifications, was employed on that line for coal traffic for many years. Six engines were built of each of the two first types and these formed respectively the "Majestic" and the "Wilberforce" classes. The classes were similar in having the same arrangement of inverted cylinders as the "*Royal George*"; these were connected to a crankshaft in fixed bearings. This shaft had no wheels on it, but power was transmitted from cranks at the end of the shaft to the whole set of six wheels by means of coupling rods.

In the "Majestic" engines the cylinders were set up in a separate frame at the front or chimney end of the engine, but in the "Wilberforce" series they were at the opposite end, again in a separate frame. This appears to have been made necessary by the difference in the boilers and the firing arrangements of the two classes. The "Majestic" class had what

was called a "straight multitubular boiler." In this a large tube or flue extended from the fire grate end for a distance of 9 ft. inside the boiler; the flue ended in a kind of tube plate from which a series of smaller copper tubes ran through the remaining 4 ft. of the boiler to the smoke-box. Here was mounted the chimney, this being of course at the opposite end from the firing end of the boiler. The boiler itself was thus 13 ft. long, and possibly for this reason these locomotives were known as "long engines" to distinguish them from the "Wilberforce" class.

The latter had boilers 10 ft. long with the favourite Hackworth return flue arrangement. There was a large tapering flue which this time began at the chimney end of the engine. Here the boiler end was flat; at the other end, which was spherical, there was a D-shaped box or chamber into which the smaller end of the flue was introduced. From the chamber a series of smaller tubes passed back inside the boiler to the flat end and into the smoke-box attached there, this smoke-box being in cross section something like a horseshoe partly surrounding the firing end of the large flue, and projecting beyond it. Thus the fireman did his work at the chimney end of the engine, and reached his fire through the sort of archway formed by the hollow centre of the "horse-shoe" smoke-box. These curious engines had two tenders, one at the firing end for fuel, and one at the other end carrying a large water cask. The disposition of these tenders varied between the two classes owing to the difference in the boiler layout. It must have been difficult to decide which direction constituted "forward" and which "backward"!

These old warriors earned their keep, and the last engines designed by Hackworth in 1842 for the Stockton and Darlington still incorporated the double-tender return-flue scheme. They had, however, the later arrangement of inclined cylinders at the opposite end from the chimney, directly connected to the crank pins of the leading coupled wheels, the intermediate crankshaft being dispensed with. This modification had been introduced in 1838 in the engine "*Tory*." As late as 1846 it was said of the "Wilberforce" class: "Take them weight for weight, they surpass any engine on the line."



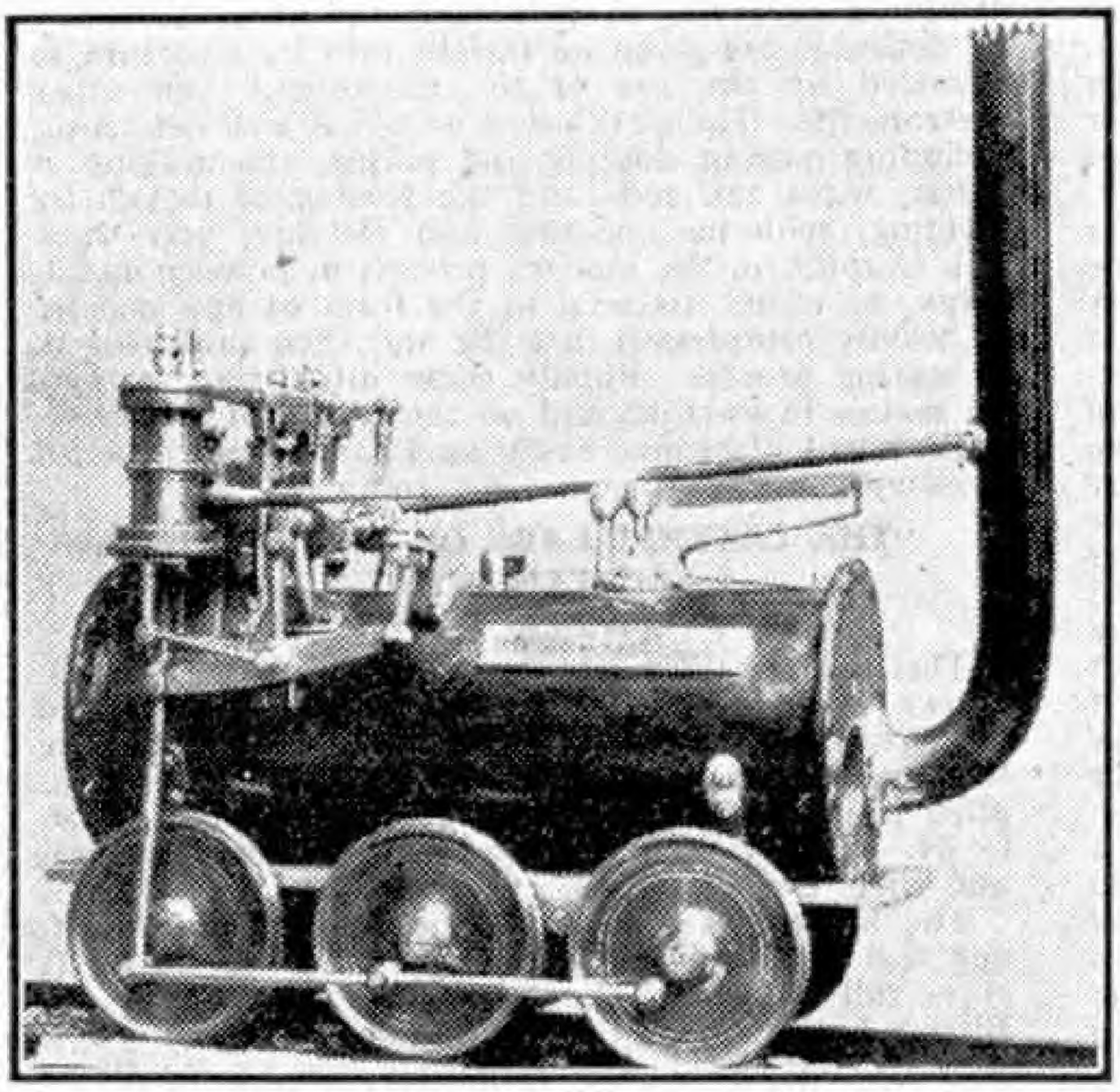
The "Sanspareil" locomotive, 1829. Photograph from the original in the Science Museum, South Kensington, London. Crown copyright.

The type in general was long-lived; the "*Auckland*" was still in use in 1875 in the service of the Consett Water Company, and in that year it was exhibited at the Jubilee celebrations of the Stockton and Darlington Railway. Another, the "*Derwent*," long a feature of Bank Top Station, Darlington, reappeared in steam 50 years later in the 1925 Centenary celebrations. Our older readers will perhaps remember the illustrations in the "*M.M.*" of September, 1925.

Incidentally the first engines to run in British North America were of Hackworth's design, being similar in fact to the "Wilberforce" class. Three of them were built in 1828 and shipped to Nova Scotia for the Albion Coal Mining Company. The first, "*Samson*," ran until 1884, and except for the last two years it was in the charge of George Davidson who had helped to build it. The veteran engine and driver appeared "in steam" at the World's Fair Exhibition in Chicago in 1893.

Special prominence has been given to these engines as a series because they were specially intended for "coal leading," to use the Stockton and Darlington phrase, and they fulfilled their part successfully in this, which was of course the principal reason for the original building of the line. The "coaching traffic" grew with the disappearance of the horse as a motive unit, after the line had been doubled to avoid the delays inseparate from single-line working under the conditions of those days. A notable engine to deal with this traffic was the "*Arrow*," which seems to have lived up to its name, for Hackworth is said to have driven it himself from Stockton to New Shildon, 19¾ miles, in 22 minutes. It is credited with having frequently attained 60 m.p.h. This engine was a 2–2–2, and had the more normal type of locomotive boiler with fire-box and tubes. It followed the lines of an engine built by Hackworth for the Russian Government in 1838.

The building of engines for service elsewhere than on the Stockton and Darlington Railway is explained by the fact that from 1833 Hackworth had worked that line by contract, supplying and (*Continued on page 178*)



Model of "Royal George" locomotive, 1827. Photograph from the original model in the Science Museum, South Kensington, London. Crown copyright.

BOOKS TO READ

Here we review books of interest and of use to readers of the "M.M." With the exception of those issued by the Scientific and Children's Book Clubs, which are available only to members, and certain others that will be indicated, these should be ordered through a bookseller. We can supply copies to readers who are unable to place orders in this manner. Order from Book Department, Meccano Ltd., Binns Road, Liverpool 13, adding 6d. for postage.

"THE LUFTWAFFE"

By C. G. GREY (Faber and Faber. 8/6 net)

The story of the Luftwaffe or German Air Force is of interest not only in relation to the present war, but also as providing an outstanding example of typical German methods. In this book Mr. Grey follows much the same lines as in his "*British Fighter Planes*," "*Bombers*," and "*Sea-Flyers*," and readers of those fine books will not be disappointed with this one.

In the first part of his book Mr. Grey deals with the start of German aviation with the early experiments of Otto Lilienthal, who made more than 2,000 glides, the longest of which was 1,000 ft. at a top speed of some 22 m.p.h. His experiments were followed by the construction of various types of motor-driven machines, most of them ingenious rather than practical. Inventors persevered, however, and before long flying really began to develop. By 1911 there were some 14 flying grounds in Germany; at the end of 1912 the German Army had 120 biplanes, 91 monoplanes, and a small number of miscellaneous craft. By 1914 the Germans were taking their Service Aviation very seriously, and big competitions for military aeroplanes were held. They began the 1914 war with a much bigger Air Force than we had, and it was not until 1916 that we definitely began to get the upper hand. The German Air Force fought well right up to the Armistice, but they were fairly beaten out of the air.

Passing on from 1918 Mr. Grey shows how, after the closing down of air activity under the terms of the Armistice, German aviation began to grow again in one way or another. He describes the beginning of the German air lines, the great enthusiasm for gliding that swept the country, the development of the Luft Hansa and the "Secret Air Force."

This brings us to the building of the Luftwaffe as we know it to-day, and in many respects this is the most interesting part of the book. Mr. Grey writes with considerable inside knowledge and gives us a graphic account of his personal experiences in Germany. One passage may be quoted: "In the autumn of 1938," he tells us, "I flew from Tempelhof to the new Heinkel works at Oranienburg. . . . . piloted by Lieut.-General Udet with the famous French aviator Detroyat as my fellow-passenger. Udet and Detroyat were rivals as the world's most accomplished aerobatic pilots, so I felt nervous about what Udet was going to do with the machine. I expected to travel most of the way upside down. But he contented himself with taking us over the middle of Berlin to show us the new arterial roads which were to cut straight North, South, East, West, through the centre of the city. When we got there he unfolded a map which he displayed with both hands while he controlled the machine with the stick between his knees and used one wing-tip or the other as a pointer to direct our attention to the places which he was indicating on the map. It was an exhibition of perfect piloting, and I have never enjoyed a flight more."

Mr. Grey's account of his visit to Germany in 1935 is of particular interest. He realised then that Germany was definitely preparing for war, and that the Luftwaffe was being built up to become the finest Air Force in the world. He tells us of his visits to German aircraft factories in that year and in 1938, and describes the principle of "dispersal," "an art which we discovered at much cost during the blitzes of 1940–41."

A chapter on the development of Germany's Airborne Troops brings us to the present war, and this final section of the book gives a review of events in the air up to the present year. Here Mr. Grey is at his best, and the story as he unfolds it is absorbing from beginning to end. A description of the Luftwaffe bombs of all kinds, and of the various types of recent German aircraft, brings to a close a very remarkable book.

The 24 pages of illustrations are well chosen and cover a wide field.

Owing to wartime difficulties, it is impossible to guarantee prompt delivery of books ordered as described at the head of this page, but every effort will be made to ensure speedy despatch.

"METALS IN THE SERVICE OF MAN"

By W. ALEXANDER and A. STREET
(Penguin Books. 9d.)

The subject of this useful addition to the well-known series of Pelican Books is especially important at present, when the command and use of metals is a vital factor in war. Iron and steel account for more than half of the contents of the book, not an undue proportion in this age of steel; but other common metals such as copper, tin and lead are adequately dealt with, as are the light metals aluminium and magnesium, and there is a satisfactory amount of information on the host of minor metals.

The stories told are not dry descriptions of ores and furnaces. Each metal is dealt with very graphically. We learn something of its history, and where necessary or desirable are given an insight into its structure as revealed by the use of the microscope and other instruments. The working of metals is well described, including casting, forging and rolling, the making of tubes, wires and rods and the joining of metals by riveting, soldering, brazing and welding; and there is a chapter on the modern process of powder metallurgy, in which material in the form of fine powder is heavily compressed in a die and then subjected to a heating process. Finally come interesting sections on metals in wartime and on the future of metals.

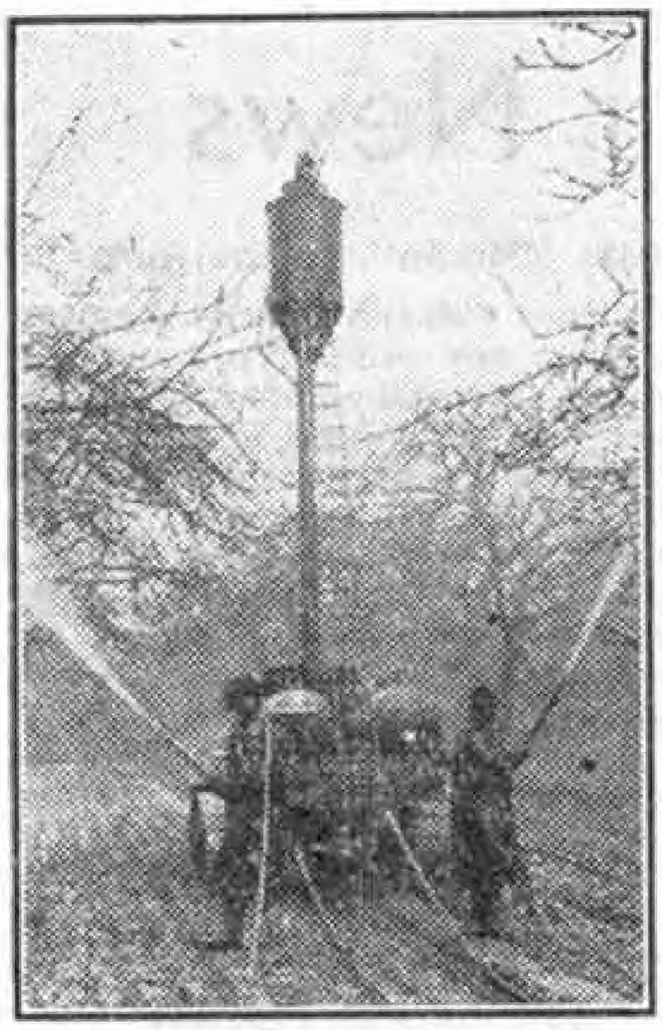
Excellent diagrams, easily read tables, and a useful glossary complete an excellent volume.

"THE CATERPILLARS OF THE BRITISH BUTTERFLIES"

(Warne. 10/6)

This is a welcome addition to the publishers' well-known Wayside and Woodland Series. It is based on "*The Butterflies of the British Isles*," by R. South, to which it forms a companion volume, and is compiled by W. J. Stokoe, with special articles by Dr. G. H. T. Stovin on rearing butterflies in captivity, and their classification.

The life cycles of caterpillars are full of interest, and the book provides a splendid guide to them. It gives full details of the caterpillars of each of our British butterflies in turn, explaining where and how they can be found, and how they can be identified, and a special section deals with the food plants of the caterpillars, associating each with those that feed upon it. The book is very well illustrated.



Tree spraying from the crow's nest.

Crow's Nest in the Orchard

Tree Spraying from Tracklaying Units

GOOD crops of fruit can only be ensured by waging constant battle in the orchard against insect pests of all kinds. The fruit-grower has various ways of reaching and destroying them. One is to surround the trunk of his trees with a sticky band to catch the wingless moths that at certain times of the year climb them in order to lay their eggs in the branches. Another, and a more important one, is to spray the trees with tar oil in order to reach the pests that are already esconced there. This is done in winter, and in order to be effective the tar oil wash must be sprayed forcibly on to every part of the tree, so that the liquid penetrates everywhere and no insect refuge is left unattacked.

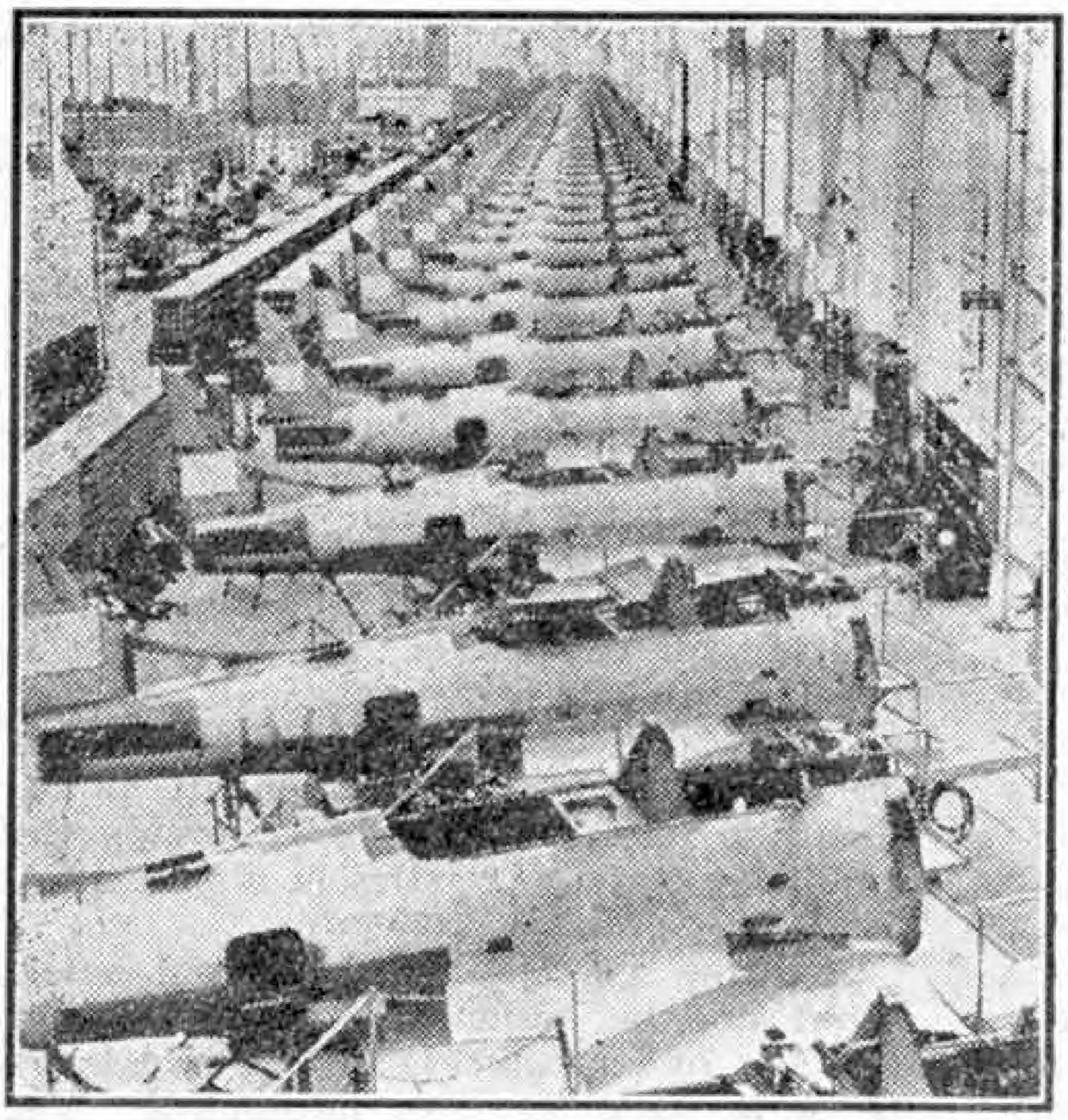
In small home gardens an ordinary spray or perhaps a stirrup pump might suffice for applying the tar oil wash, and for those with a larger number of trees there is special apparatus, working under air pressure, that can be carried on the back. Spraying in the great commercial orchards of Kent and other parts of the country demands larger and more complicated apparatus, however, and a Kentish grower has devised what appears to be the best, cheapest and most effective. He makes use of a trailer carrying pumps that are fed with tar oil from stand pipes placed at various positions in the orchard. The trailer is mounted on Orolo track units which can be used on the heavy cultivated ground under and between the trees, where wheeled vehicles would be impracticable, and the outfit is hauled by a tractor that is similarly equipped.

The apparatus that this grower uses is of his own design and is illustrated on this page. His first idea was to carry the tar oil itself on the trailer, but he found it better to distribute this through pipes to various places in the orchard, tapping it off from the nearest convenient point. Then the pumps go to work, forcing the liquid out through nozzles in a fine spray under pressure.

Directing a pressure spray from below would not be sufficient for the highest branches of large trees, as it would leave the uppermost surfaces untouched. Yet they must be tackled thoroughly, for the insect pests tend to congregate on the highest parts of the trees. For this reason the trailer is fitted with its most conspicuous feature, which can best be described as a crow's nest. This is carried on a tall column in order to bring it high above the trees, and is reached by a ladder. As our illustrations show, the sprayer who occupies the lofty post can direct the spray on to the highest portions of the trees and so make sure that no part is left untreated.

This unique fruit tree spraying apparatus is mounted on Orolo track units.

We are indebted to Roadless Traction Ltd. for our information and illustrations.



Looking down the long assembly line of "Dauntless" dive bombers at the Douglas Aircraft Company's plant in California, U.S.A.

Another Good Flight by a "York" Transport

In our article on the Avro "York" in last month's "*M.M.*" reference was made to an excellent British-Cairo flight by one of these machines in service with Transport Command, R.A.F. Now comes news of another good performance by a "York" of that Command. On this occasion the machine, captained by Flt. Lieut. E. Wright, D.F.C., and with 8,000 lb. of urgent supplies on board for the South-East Asia Command, flew to Delhi, and covered the 6,857 miles in 31 hrs. 54 min. flying time, an average of 214.9 m.p.h. The pilot went by the regular Cairo-Karachi air route, and stops on the way added just over 10½ hrs. to the journey time, the overall time being 42 hrs. 30 min. Bad weather was encountered during the early part of the flight.

More "Mosquito" Variants

It is becoming increasingly difficult to keep pace with the growing number of D.H. "Mosquito" variants, for there seems no limit to the uses to which this remarkable aircraft can be put. The latest version carries a 4,000 lb. "block-buster" on sorties over Germany and Occupied Territory, and thus presents the Hun with another headache, as it now carries a bomb load equal to that of our "heavies" of three years ago. This is a great tribute to the sturdy construction of the "Mosquito" and to the far-sighted policy of its designers, for it was originally intended to carry a bomb load of only 1,000 lb.

J. W. R. TAYLOR.

* * * *

A "Mosquito," with a D.H. test pilot at the controls, has been flown from Toronto to New York, a distance of 377 miles, in 55 min., an average speed of 411 m.p.h.

Air News

The 100,000th "Merlin" Engine Built

More Rolls-Royce "Merlin" aero engines have been built than any other type, and the 100,000th "Merlin" was completed recently. This famous type was introduced in 1927, and the extent to which it has been improved since then is shown by the fact that the first of these engines developed 1,000 b.h.p. for take-off, while the latest version of which performance details are available develops 1,650 h.p., an increase of 65 per cent.

"Merlin" engines have been used in many famous types of aircraft, and five types in which they are giving splendid service to-day are the "Spitfire" IX, "Mosquito," "York," "Halifax" II, and "Lancaster" III. The last-mentioned machine has "Merlins" produced by the Packard Company, of America.

Canadian Pacific Airlines Progress

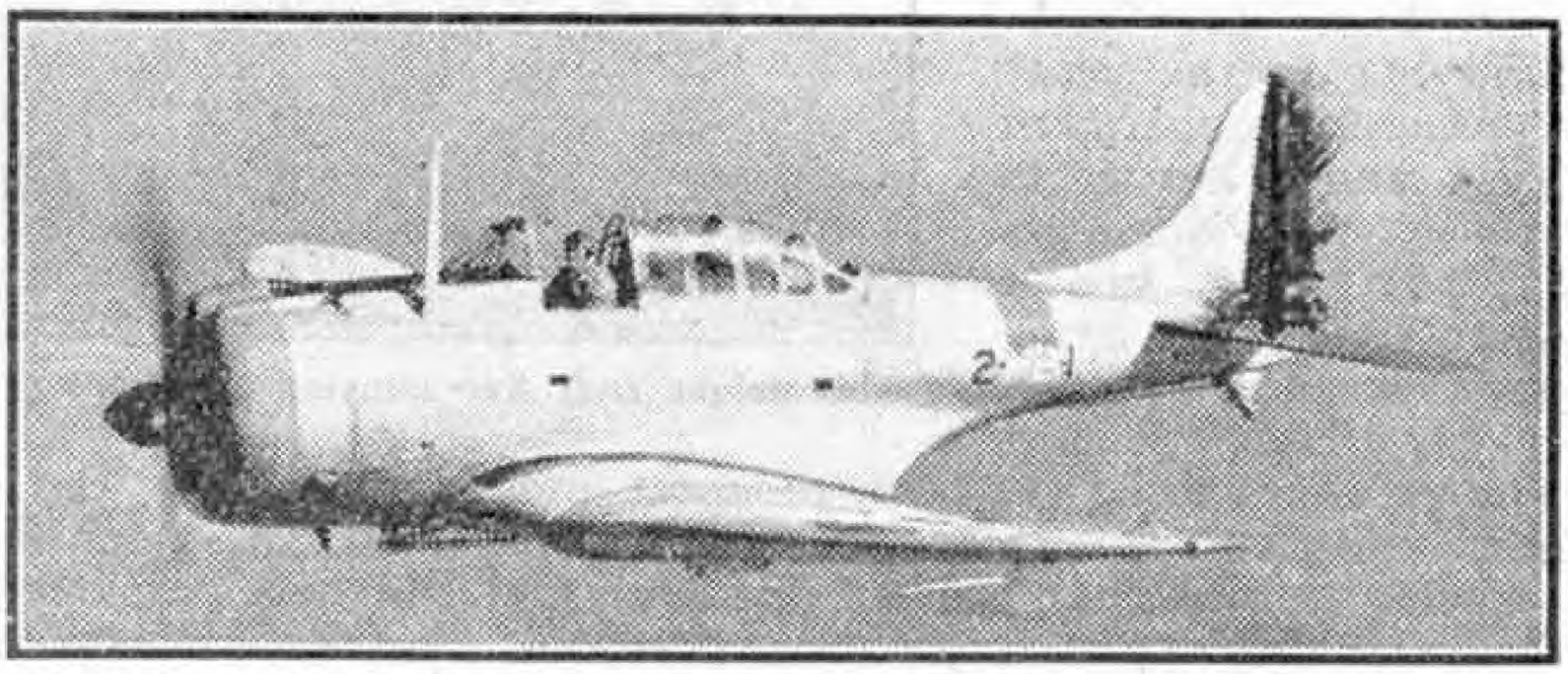
Impressive 1943 air traffic figures have been published by Canadian Pacific Airlines. Last year the company's aircraft carried the huge total of 71,696 passengers, an increase of 24 per cent. over the 1942 figure, and equivalent to 196 passengers every day of the year. Air freight amounted to 9,489,417 lb., which was 1 per cent. less than the previous year's total and averaged just under 26,000 lb. per day. Air mail dealt with weighed 2,197,417 lb., an increase of 28 per cent. over the quantity handled in 1942. On the basis of 40 letters to the pound, 239,717 air mail letters were carried daily.

War Supplies Flown 11,500 Miles

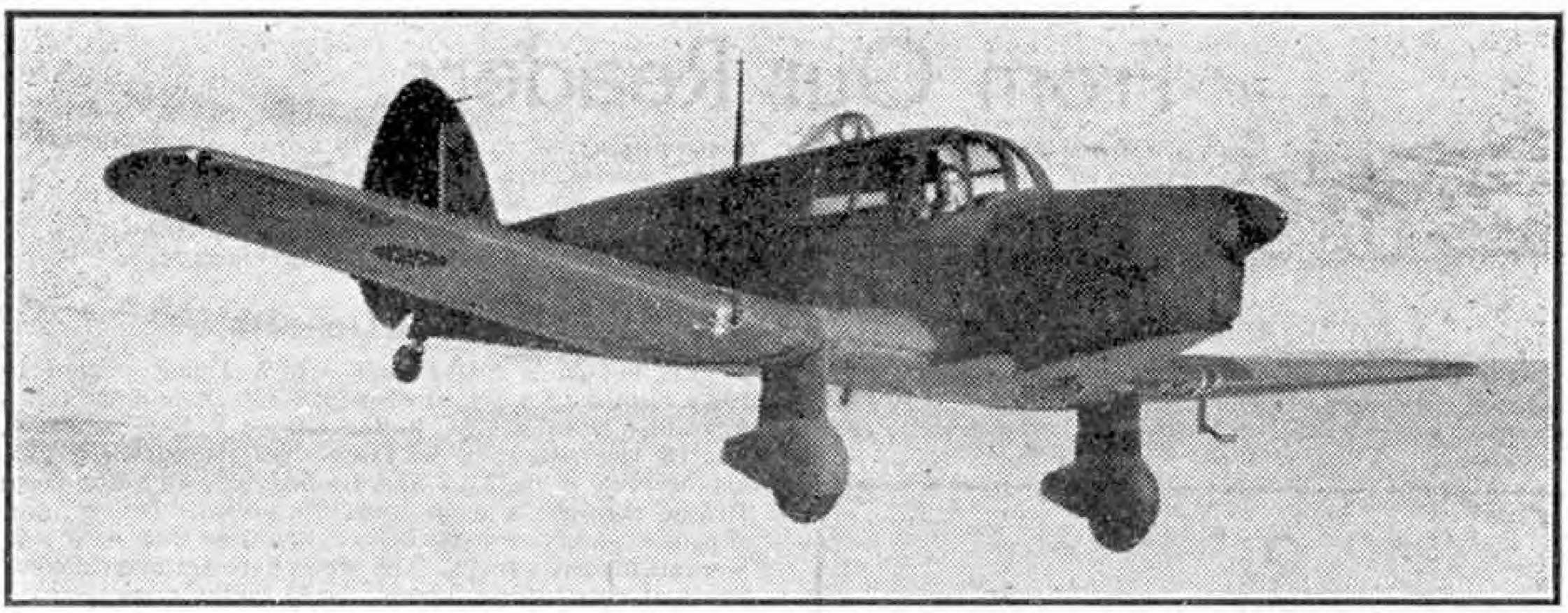
A striking instance of how effectively war supplies can be transported quickly to distant battle fronts is provided by the 11,500-mile service between the United States and North India operated by Pan American Airways for the U.S. Army Air Transport Command. The aircraft employed on this Florida-North India service have to fly over two oceans and four continents as they rush war supplies from America to General Stilwell's Army in Burma. The round trip is accomplished in about 180 hrs. and more than 2,200 transatlantic flights have been made since the service began in November, 1942.

* * * *

Since Mr. Curtin, Prime Minister of Australia, announced that the Commonwealth Government had decided in favour of the production of heavy bombers in that country, it has been reported that the Government have authorised the spending of £1,250,000 on the manufacture of high-powered liquid-cooled aero engines.



"Dauntless" dive-bombers are being used with great success in the Pacific war zone. Here one is seen in the air.



Percival "Proctor" IV, the latest R.A.F. wireless and navigational trainer and light communications aircraft. The main structure is of wood, and plastics are used for many lightly stressed parts.

The Percival "Proctor" IV

Details of the Percival "Proctor" IV, illustrated above, are now available. This machine, at first named the "Preceptor," is the latest R.A.F. wireless and navigational trainer, and is also in service on communications duties. It has been developed from the "Proctor" I, and is a wooden-built low wing monoplane of 39 ft. 6 in. span, with wings that can be folded back to facilitate storage. It is fitted with a 210 h.p. D.H. "Gipsy Queen" II engine.

The "Proctor" should prove of great value after the war as a private-owner type aircraft, as it can seat four persons very comfortably, and can fly 15 miles on a gallon of petrol, which makes it more economical than some large cars. J. W. R. TAYLOR.

German Warplane Developments

Since the war began the Luftwaffe has received very few new types of aircraft. The policy has been mainly one of improving existing types to further step up performance and fire power, rather than incur the loss of production involved in changing over to the production of new types of machines. Some new designs have appeared, of course, such as the Focke Wulf Fw 190, but on the whole the R.A.F. is to-day facing German aircraft similar in outward form to the Messerschmitts, Heinkels, Junkers, and Dorniers that opposed it in 1940. This is contrary to practice in this country, where production has been made secondary to ensuring that our pilots fly the finest and most up-to-date fighters and bombers in the world. Results have proved that the British practice is the wise one.

It is too late for the Luftwaffe to change its policy, and the latest batch of new German types are merely variations on the old themes. First, there are the new Dornier bombers, Do 217 K1, K2 and M1, which have been used in recent tip-and-run raids on this country. Several of them have been shot down, at least one in good condition. The Do 217 K1 and K2 are in general similar to the old Do 217 E, but have a redesigned nose, which is very large and bulbous. Instead of a "step-up" to the windscreen, the old glass nose has been extended upward to fair in with the cockpit cover. Armament consists of two cannon and four machine-guns, and the loaded weight is 35,000 lb. The K1, fitted with either two 1,600 h.p. B.M.W. 801 or B.M.W. 802 engines, and without bomb load, has a top speed of 315 m.p.h.

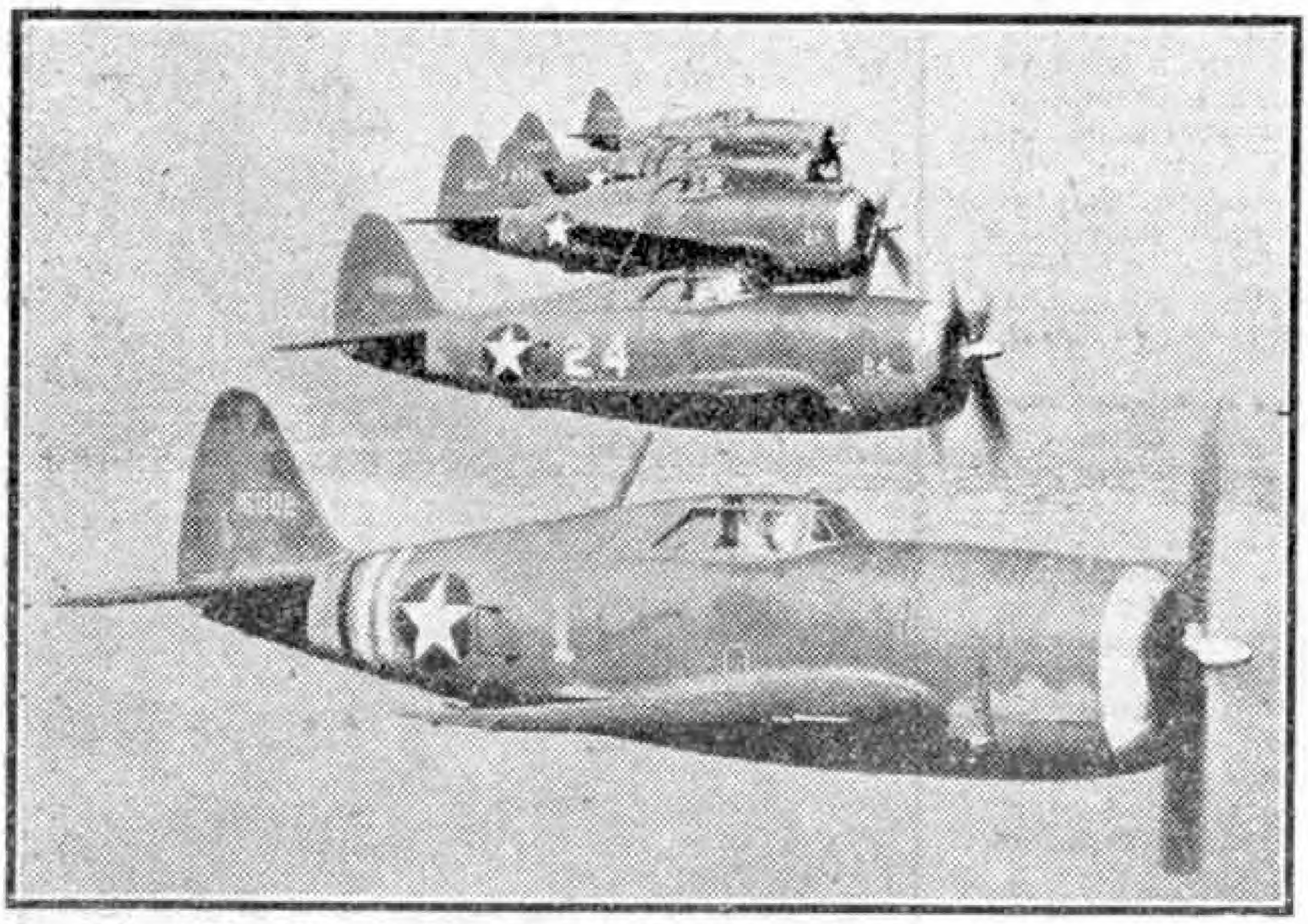
The twin-engined Junkers Ju 188 has been developed from the well-known Ju 88, and differs from it mainly in having a redesigned nose in which the nose and the cockpit form just one "glasshouse," as on the Dornier Do 217 K1. An additional gun turret has been incorporated on top of the cockpit cover, bringing the armament up to one 20 mm. nose cannon, two dorsal 13 mm. machine-guns and two ventral rifle-calibre machine-guns. Top speed is about 290 m.p.h.

Other reports concern the latest developments of the Focke Wulf Fw 190. The "Moskito" is now known to be fitted with a Junkers Ju 213 in-line engine, and in consequence has a much longer nose than the Fw 190. The Fw 290 is believed to be similar in most respects to the Fw 190, but has a new 2,100 h.p. B.M.W. engine.

J. W. R. TAYLOR.

* * * *

"Blimps" of the U.S. Navy are doing good work in rescuing American airmen forced down in the Amazon forests and the deserts of Central and North-East Brazil, and at least 500 such rescues have been achieved.



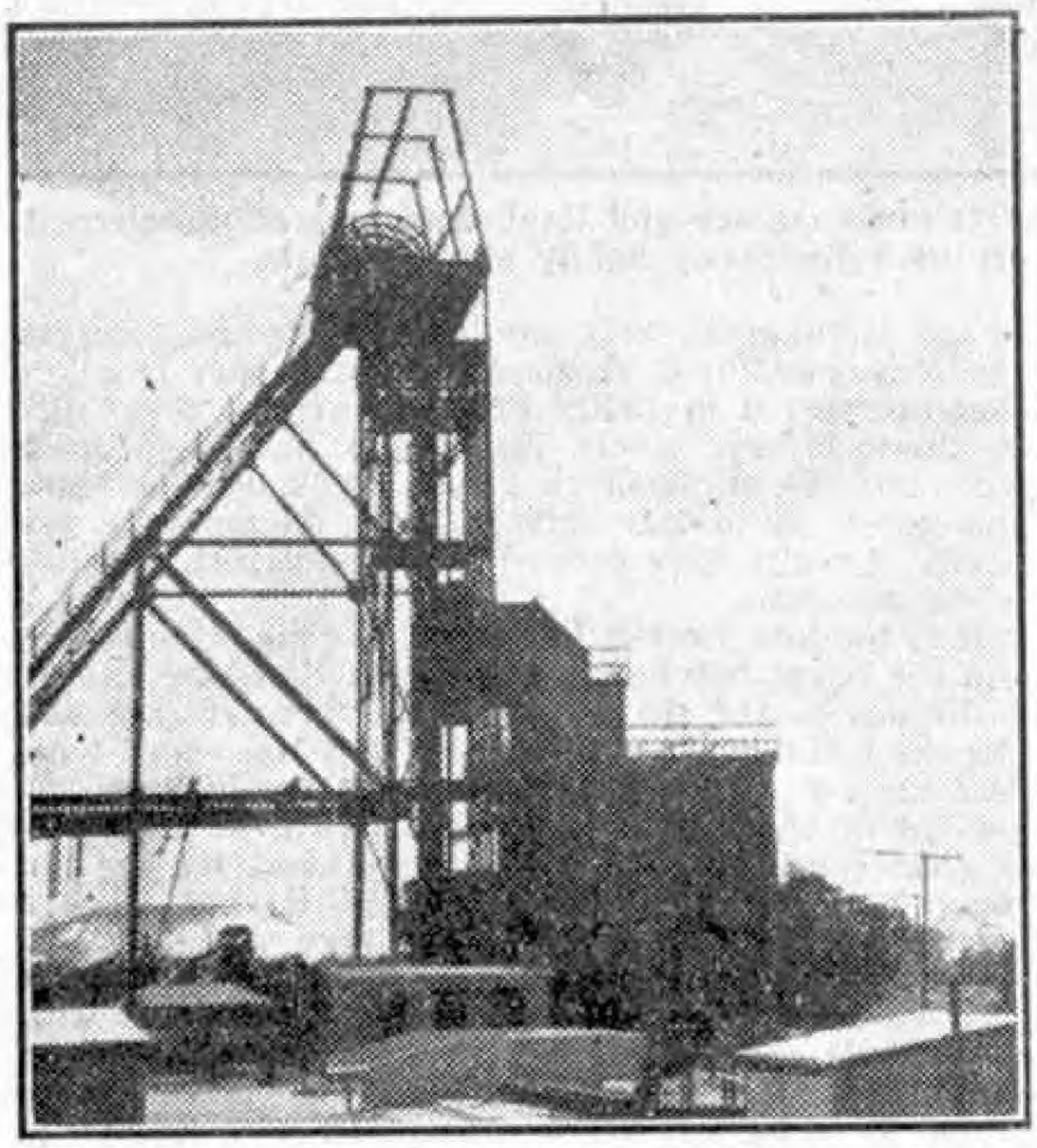
Republic "Thunderbolts," one of the types of aircraft doing fine work escorting American heavy bombers in their daylight raids deep into Germany. **(See special article on page 153).**

From Our Readers

This page is reserved for articles from our readers. Contributions not exceeding 500 words in length are invited on any subject of which the writer has special knowledge or experience. These should be written neatly on one side of the paper only, and should be accompanied if possible by original photographs for use as illustrations. Articles published will be paid for. Statements in articles submitted are accepted as being sent in good faith, but the Editor takes no responsibility for their accuracy.

A SOUTH AFRICAN GOLD MINE

Recently I was given the opportunity of going over a Rand gold mine. For one who had lived a good while on the Reef, seeing the huge white mine dumps each



The head-gear of a South African gold mine. Photograph by R. M. Gameson, Johannesburg.

day, a chance to go underground was not to be missed.

After being shown over the generating station, my companions and I were given underground clothes and lamps and taken into the skip in which we were to make the descent. This was a double-decker, in which we were in the lower half. Natives going on night shift then entered the upper half, and the sliding doors were closed. The mine captain rang us away and we slid downward at a rapidly increasing pace. We were told to swallow hard, as we were travelling at 2,700 ft. per min., or about 30 m.p.h., and finally the skip was pulled up at a level of 4,500 ft. below the surface.

We emerged into a brightly lit level where ore was being transferred from trucks to haulage skips. The mine captain took us along newly cut haulages to a stope where the gold reef itself was visible. We were given picks and invited to cut ourselves samples of quartz, a piece of which I have now. This stope and the haulages around are cut through solid rock and are therefore not shored up as yet. I was amused at the nonchalance of the mine captain as he stood beneath a crack in the rock roof, and asked us to stay and listen to the rock "talking" as it settled. Needless to say, we did not wait, and a little later were delivered safe to the surface after four hours below ground. An interesting tour, but nevertheless I was glad to see the stars.

While below ground I was specially interested in the intricate railway system, all electrified. There are 45 electric locomotives on lines connecting with this shaft alone. R. M. Gamerson (Johannesburg).

THE SIMPLON PASS

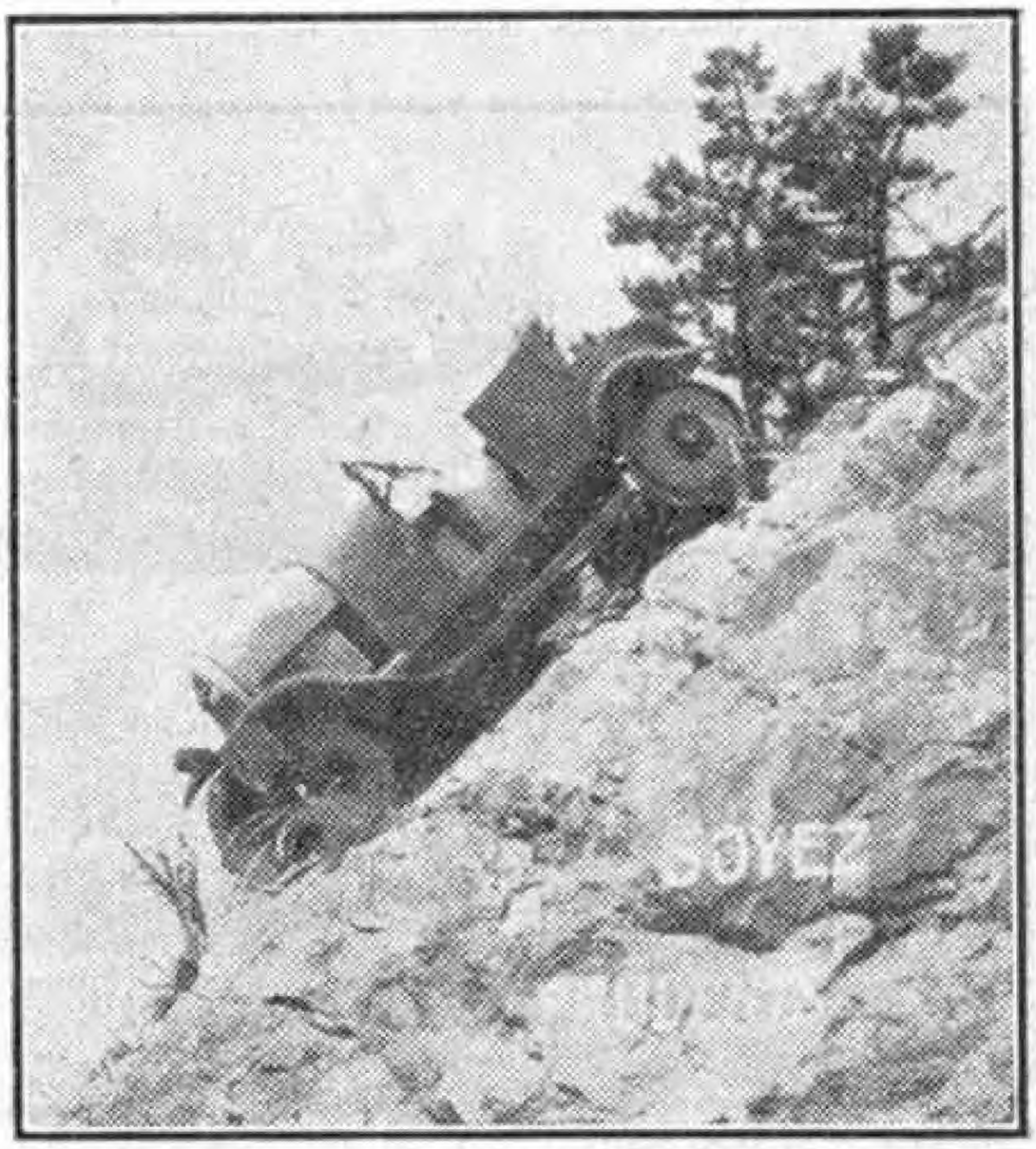
This beautiful Swiss pass, which I last visited in 1939, climbs to a height of over 6,500 ft. and stretches 12¼ miles from Brigue, in the Rhone Valley, to Iselle, one of the gateways to Italy. On its northern side the scenery is luscious and friendly as it climbs from Brigue through a gorge, over Napoleon's Bridge, and through shady woods before opening out near the summit in easy sweeps. The views here are magnificent, particularly of Monte Leone, the 11,600 ft. peak beneath which is the Simplon Tunnel.

On the way the dilapidated automobile shown in the accompanying illustration is seen on the steep mountain side. It warns all travellers to take care, for the easy, gentle road from the summit suddenly changes to a series of acute hair-pin bends on which an over-confident traveller could very easily come to grief. The make and vintage of the car seem to be unknown, but an old fellow who was mending the road assured me that it was the remains of a car that had once crashed there.

Another feature of interest in the Pass is the Augustinian Hospice at the summit, which is an offshoot of the more famous one at the top of the Grand St. Bernard. It takes little imagination to realise how much these havens must have meant to old-time travellers, for in spite of modern amenities and safeguards the summits of these passes are savage and awe-inspiring, even in the best weather.

The descent to Italy through Gondo and Iselle is more rugged and austere than the northern side. Several galleries are cut through solid rock, and over one pours a fall known as Kaltwasser Gletscher, or Cold Water Glacier, that makes the inside of that small tunnel as icy as a refrigerator.

R. R. Bushell (Belfast).



A grim warning. A car said to have crashed on the Simplon Pass. Photograph by R. R. Bushell, Belfast.

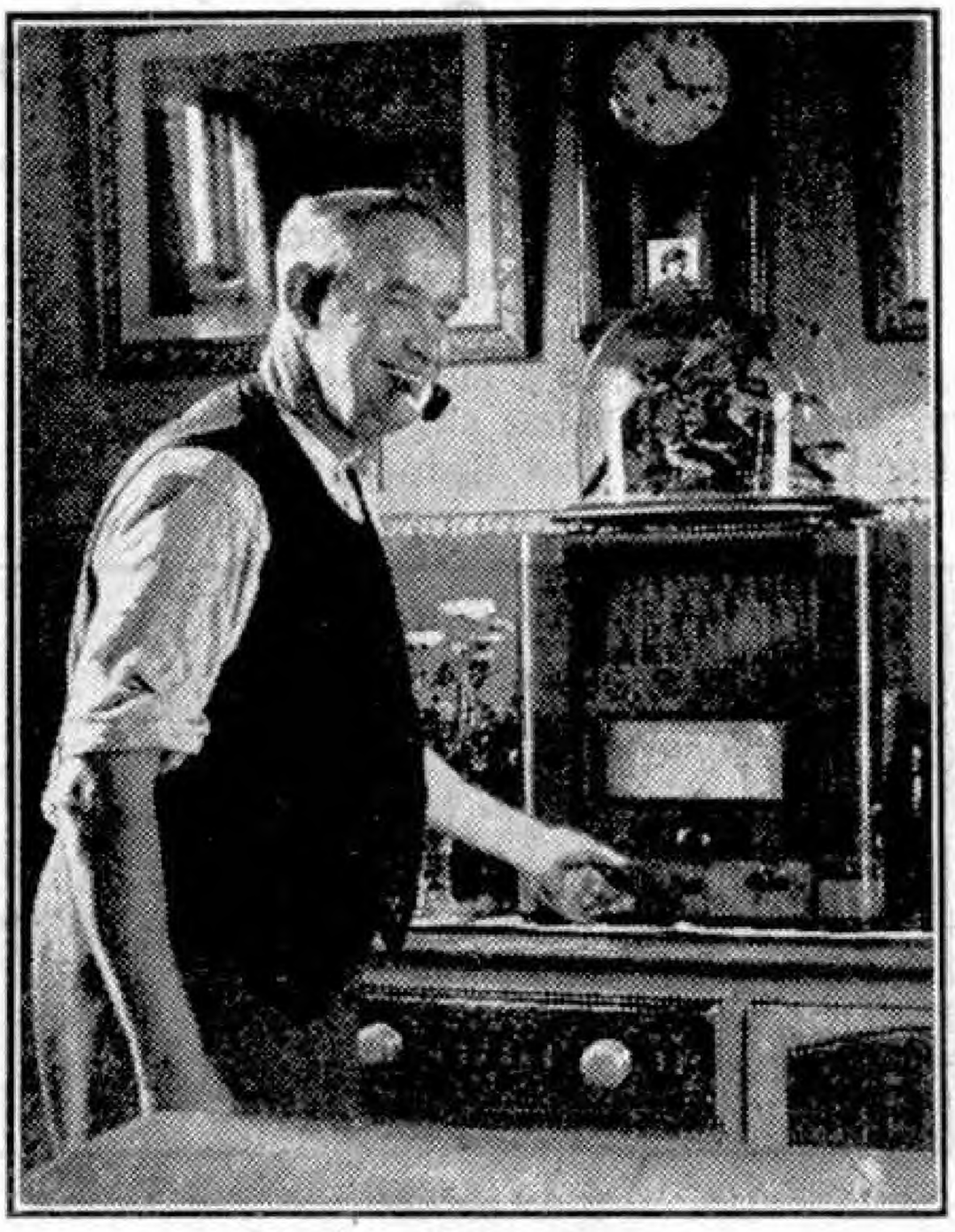
Photography

Portraits That Please

By E. E. Steele

MOST people who have cameras get a lot of fun out of making portraits of their friends, but they usually go about the job with very little idea as to the methods of making snaps that really please. Examine any average family album and you will see what I mean. Here we find photographs of people staring directly at the camera with various agonised expressions, and obviously not feeling at all at their ease. Very few persons have the gift of posing naturally when looking full at the camera, and it is much better to arrange for your subjects to be doing something. Then they are at once put at their ease, and have something to do with their hands, instead of hanging them lifelessly down their sides.

Have your friends doing the natural things that they do every day, and which they enjoy doing. That favourite uncle tuning-in to a well loved wireless programme, for instance, or filling his pipe, or engaged in his garden. He will enjoy being photographed in this way, and will co-operate to make it a success, instead of feeling that "get it over quickly" sensation that most people express when posing for their picture to be taken.



His favourite programme.

Boys, especially, are active beings, and look odd when posed in that stuffed dummy fashion which seems to be the method prevailing with many amateur portrait photographers. Take a boy at his hobby indoors, or out in the fields where he is in his element, or climbing a tree, or anything that he really enjoys doing, and you will have something more nearly approaching a picture than just a mere record of his features.

Another great fault with amateur portraits is the nasty spotty backgrounds that so often mar otherwise interesting pictures. Novices will persist in taking their pictures in front of chicken runs and similar disturbing things, and it is common to see trees and telegraph poles miraculously growing out of people's heads! All this could be avoided by just a little forethought and arrangement before clicking the shutter. Probably all that is necessary is to move a pace or two to the left or right to avoid an incongruous object that shows in the viewfinder of your camera. You may not have noticed it at the time, but it will be there on your print, and it will make all the difference to the result.

The farmer's wife.

Suggestions Section

By "Spanner"

(640) Differential For Sprocket Drive

("Spanner")

The differential shown in Fig. 640 is intended for use in a Meccano lorry, motor, etc. where the usual shaft drive has been dispensed with and Sprocket Chain drive

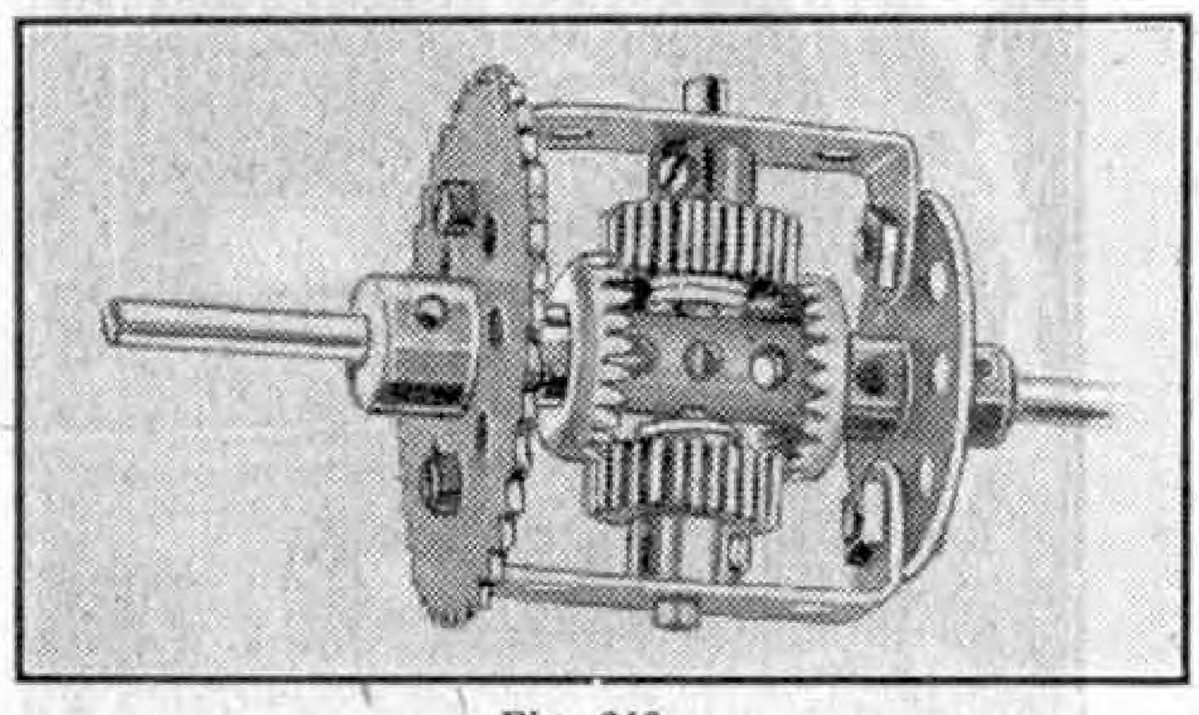


Fig. 640.

substituted. A 2" Sprocket Wheel is secured to a Bush Wheel by means of two $1\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strips, each of the four Bolts carrying a Washer for spacing purposes. A Rod of sufficient length to reach one of the road wheels is now passed through the boss of the Sprocket Wheel and fitted with a $\frac{3}{4}"$ Contrate Wheel. Sufficient Rod is left projecting in order to allow it to pass into the longitudinal bore of a Coupling. A second Rod passing through the Bush Wheel is fitted with a Contrate Wheel and treated in the same way as the first Rod.

The transverse bore of the Coupling is fitted with a 2" Rod secured in place by a Grub Screw. This Rod forms a bearing for two $\frac{3}{4}"$ Pinions each of which is spaced away from the Coupling by means of two Washers, so that the Pinions fit snugly against the Double Angle Strips forming the frame of the mechanism.

(641) Electric Motor Controller

("Spanner")

The electric controller shown in Fig. 641 is designed to regulate the speed of the Meccano 6-volt Electric Motors. The device can be incorporated in almost any model that is driven by a 6-volt Motor.

The resistances are formed from Spring Cord, which must be opened out so that none of its coils is in contact with the next. The Spring Cord is attached at equal distances to 6 B.A. Bolts 1, which are insulated from the Bush Wheel 2 by means of Insulating Bushes and Washers. The heads of the Bolts form the contact studs. The seventh stud 3 is not connected in any way, and forms the "off" position of the Crank carrying a Spring Buffer 5, the head of which presses lightly on the contact studs. The switch arm pivots on the upper end of the supporting Rod and is retained in place by a Collar 7.

One of the Motor terminals is "earthed" by connecting it to the metal frame of the model, while the other terminal is connected direct to one terminal of a Transformer or an accumulator. The remaining terminal of the accumulator is connected to the terminal 8, which is mounted on the shank of the first contact stud.

In order to limit the movement of the switch arm a stop 9, consisting of a portion of a Spring Buffer, is bolted to the Bush Wheel 2. When the contact 5 is pressing on the contact stud 3, no current is supplied to the Motor.

(642) Winding Gear for Large Cranes

("Spanner")

This mechanism, which is shown in Fig. 642, may be incorporated in many

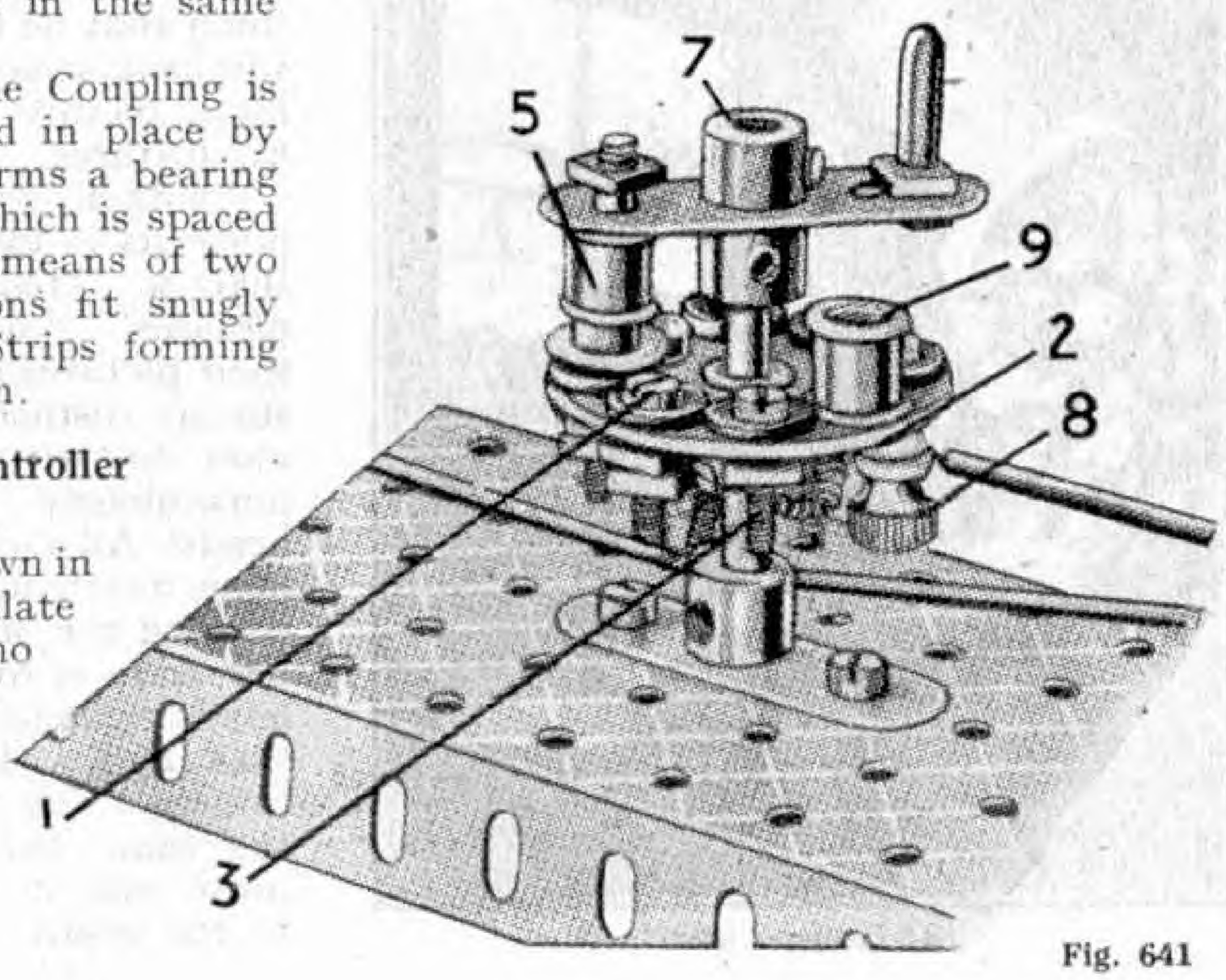


Fig. 641

different types of Meccano cranes. The shaft of the winding handle 1, fitted with a ½" Pinion 2, carries a Spring at one end between the Pinion and the framework. The Spring tends to retain the operating shaft in such a position that the Pinion 2 is out of engagement with the 57-teeth Gear Wheel 3 on the winding drum shaft. Consequently, in order to rotate the drum the hand wheel 1 must be pushed inward while it is rotated. When it is released the Spring returns it to its former position, throwing the Pinion out of mesh with the Gear Wheel.

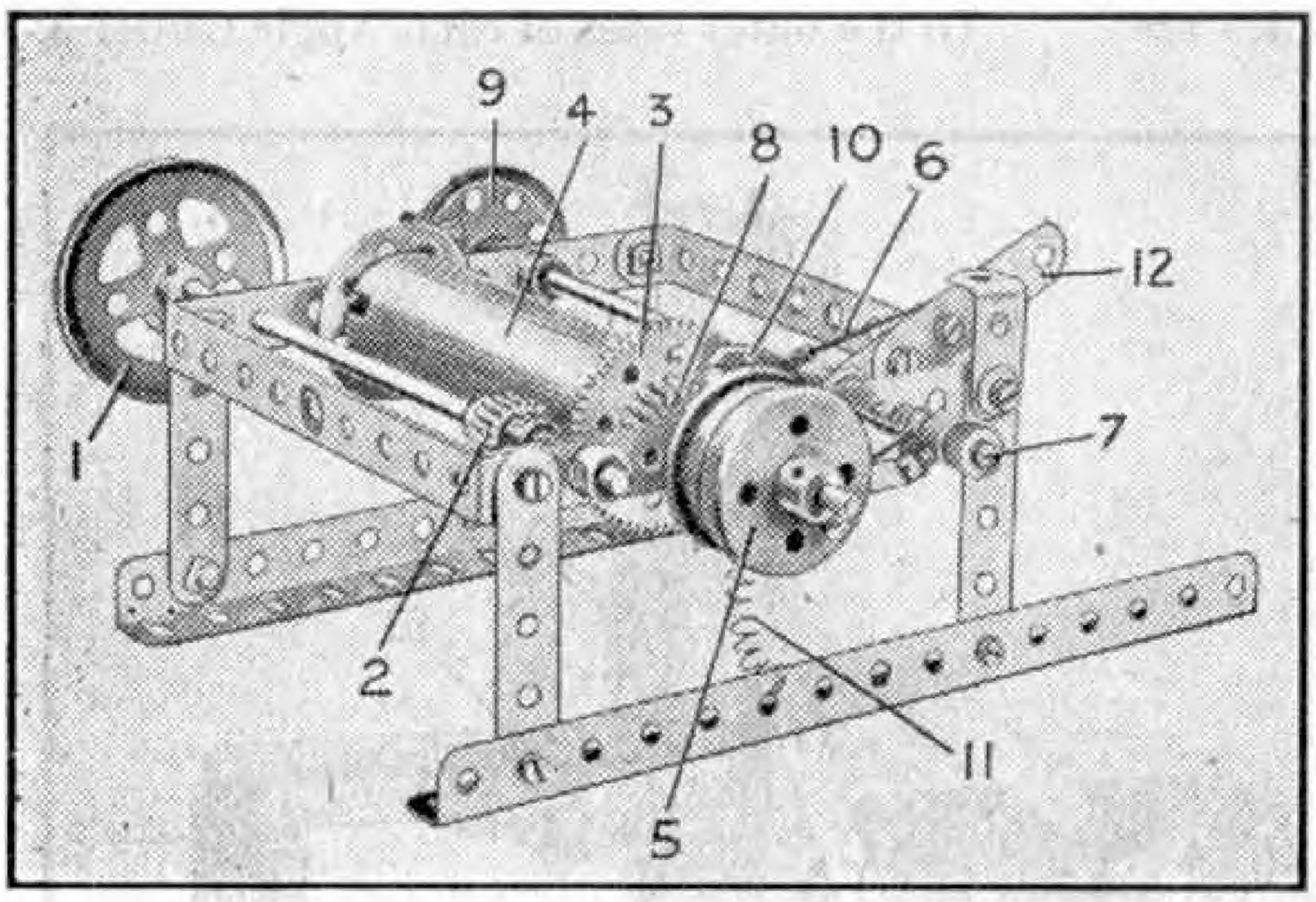


Fig. 642.

On one end of the drum 4 is a Flanged Pulley 5, formed from the two Flanged Wheels placed rim to rim and a Ratchet Wheel 8. Around this pulley a brake band 6 is passed. One end of the band is tied to a Bolt inserted in a Collar on a Rod 7, and the band is then wound two or three turns around the flanged pulley. The other end of the band is tied to the shaft 7 as shown. When the handwheel 9 on the shaft 7 is rotated the brake band is wound up and so exerts a braking effect on the winding drum shaft.

The Ratchet Wheel 8 is engaged by a Paul 10, a piece of Spring 11 being used to keep the two parts in contact. This Pawl and Ratchet device forms a safety mechanism to prevent the load from falling when the winding handle is released. The Pawl can be raised from the Ratchet when the load is to be lowered by pressing on the pivoted Strip 12, which is connected by a piece of Cord to the Pawl. The band brake operated by the shaft 7 is intended to exercise control over the rate of lowering. If desired, however, the load can be allowed to run down under its own weight, simply by raising the Pawl and releasing the winding handle 1.

(643) A Low Friction Bearing ("Spanner")

In some models, such as weighing balances and devices for recording harmonic motions, special low friction bearings are required, and usually a type of support known as a knife-edge bearing meets this need. In this device, one edge of a steel or agate prism forms the bearing and in Meccano this can be replaced by the points of a Centre Fork secured in a Coupling. In a Meccano balance, for instance, the points of a Centre Fork fitted in this manner rest between the teeth of two ½" Pinions bolted to a short Rod that is held rigidly at each end in a Crank 4. This provides the bearing for the beam, which is secured in the centre hole of the Coupling, so that it pivots on the line of the points of the Centre Fork.

(644) Fixing Nuts in Awkward Places ("Spanner")

Sometimes when building a model, nuts have to be put on bolts awkwardly placed for access by the fingers. In some cases I find that the job can be made easier by the use of a small magnet, preferably one in the form of a thin rod. The nut is placed on one end of the magnet, where it is held firmly while being placed over the bolt. The magnet is then rotated in order to "start" the nut on the bolt thread. While a rod type magnet is most useful in this respect, a flat bar magnet can be used successfully.

An alternative method is to use a small tube spanner. A tool of this kind can easily be formed from a short piece of brass tube of suitable diameter to allow one end of it to be "squared" to take a nut. "Squaring" can be done either by squeezing the tube in a vice or by hammering it lightly.

Model-builders to whom neither of these methods is available may care to try a further method suggested some time ago by a reader of the *"M.M."* This provides for a dab of Plasticine placed on the end of a long Meccano Rod. The nut is pressed on to the Plasticine, which holds it securely while it is manœuvred into position and "started" on the Bolt. The nut can then be detached by moving the Rod sideways.

New Meccano Model

Log Sawing Machine

ONE of the most valuable of all the tools man has devised is the saw. Its chief use as we know it to-day is, of course, to saw wood, and the enormous logging operations carried on in the vast forest regions of Canada and Australia, etc., have given a great impetus to the improvement of the saw in both design and methods of manufacture. In one of the most widely used log saws, blades are fixed on frames attached to a reciprocating beam, which moves up and down. The log is placed on the table of the machine and carried slowly against the edges of the saws while the latter are in motion. The distance between the blades is adjustable so that the timber can be sawn into planks of any thickness.

A fine Meccano model of a log sawing machine of this type is shown in Figs. 1 and 2. The model is quite simple to construct and in the hands of a Meccano boy is capable of providing much good fun and pleasurable instruction.

The operation of the model is as follows. The Pulley Wheel 14 is attached to an Electric or a Clockwork Motor and drives the shaft 8 carrying the Worm Wheels 12, which impart motion to a set of rollers that carry the "log" to the saws. The saw frame 16 is operated by connecting links and cranks 17 and 18, which cause the frame to oscillate in a vertical plane.

The construction of the model should be commenced by bolting two 12½" Angle Girders 1 to two 3½" × 2½" Flanged Plates, as shown in the illustrations. To the top of each Flanged Plate 3½" × ½" Double Angle Strips 2 are secured to form supports for the two 12" Angle Girders 3, which may now be secured in position. The two vertical 9½" Angle Girders 4 are bolted to the Angle Girders 1.

At the operating end of the base frame two 4½" × 2½" Flat Plates 5 are bolted to the Angle Girders and to the sides of the Flanged Plates. At the front end of the framework a 2" Strip 6 is secured as shown and to this is attached a 1" × 1" Angle Bracket, while a further 1" × 1" Angle Bracket 7 is secured to one of the Flat Plates 5. It is important to note here that the outer end holes of the Angle Brackets must be exactly opposite each other, as these two Brackets carry the shaft 8.

To the outer sides of each Angle Girder 3 are bolted two 1" Triangular Plates, and two Handrail Supports are fastened to the lower ends of the Girders 4 to form the supports for the guide rods 9. Any further details of the framework will be quite clear from the illustrations.

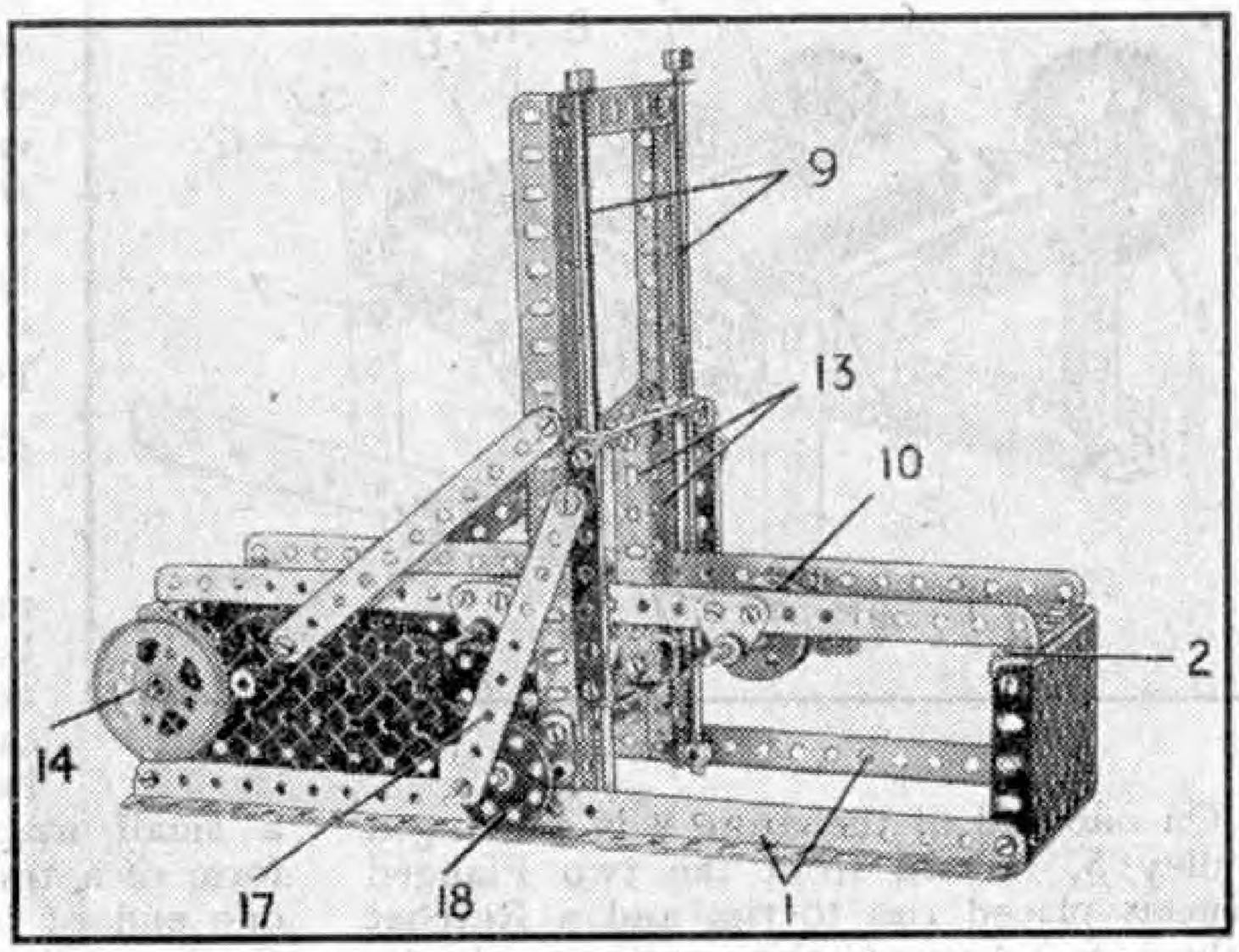


Fig. 1. One side of the fine Meccano model of a log sawing machine described in this article.

The log is caused to move past the saws by the pairs of reversed Flanged Wheels 10. These Wheels are driven from the two ¾" Pinions 11, which are engaged by the Worms 12 carried on the Rod 8. This Rod is held in its bearings by means of two Collars.

The movements of the Flanged Wheels and of the saws 13 are effected simultaneously from the driving Pulley Wheel 14, the Rod of which carries a ½" Pinion that engages a 57-teeth Gear Wheel. A Bevel Wheel 15 is carried on the outer end of the Rod of the Gear and engages a corresponding Bevel carried on the end of Rod 8.

The saws 13 represented by Rack Strips are carried in a frame 16, which is movable vertically on the guide rods 9, a reciprocating motion being given to the frame by the link Strips 17. These consist of two 4½" Strips, one on each side of the machine, and are connected to the frame by Bolts lock-nutted to the frame and spaced with Collars. The lower holes in the Strips are held by Bolts carried in Bush Wheels 18. The Rod on which the Bush Wheels are mounted carries a ¾" Sprocket Wheel, which is connected by Sprocket Chain to a Sprocket Wheel on the spindle of the 57-teeth Gear Wheel.

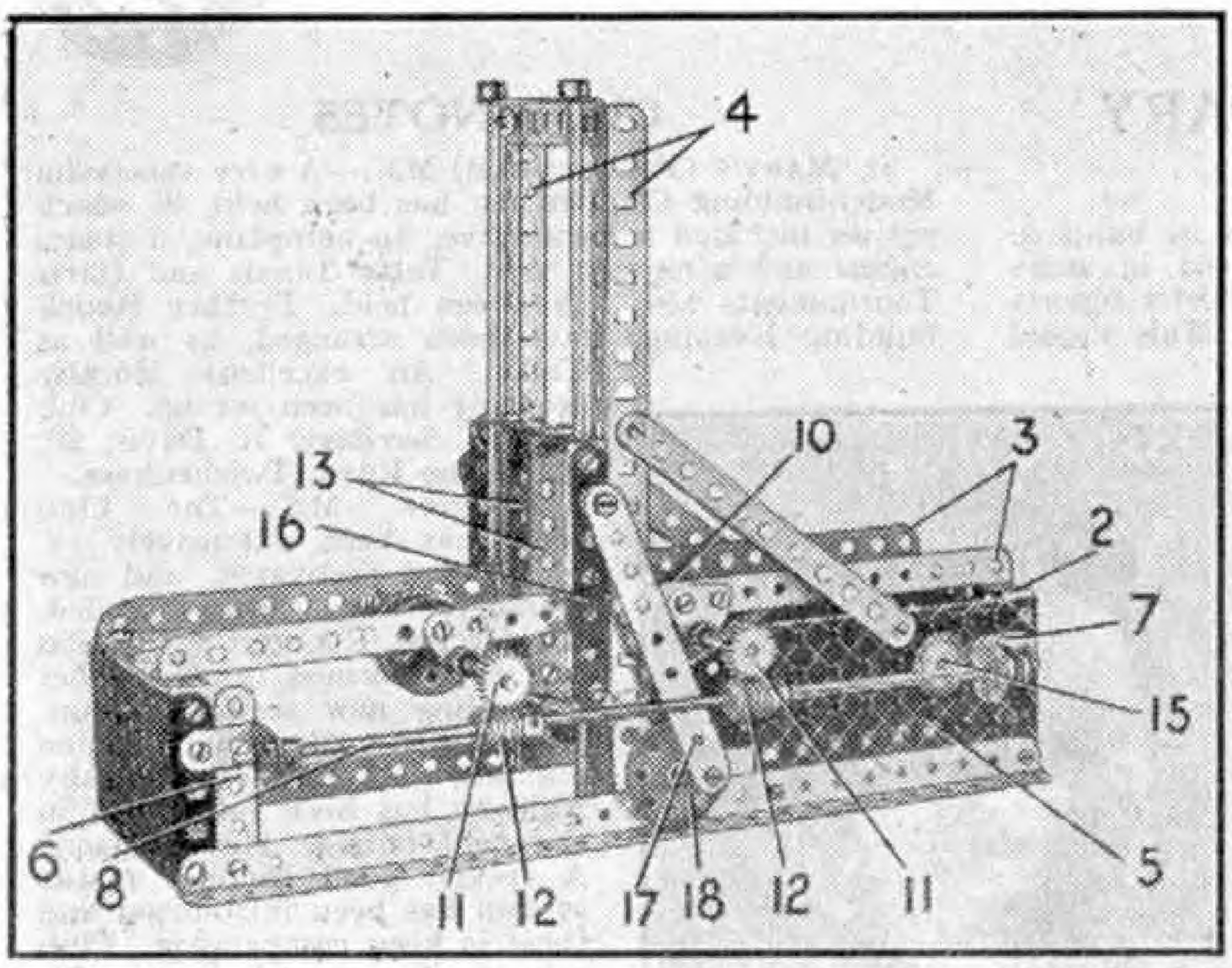


Fig. 2. The model can be driven by either a Clockwork or an Electric Motor through a Pulley Wheel connected to the main shaft.

The saw blades are secured in a rectangular frame built up from four 3½" Strips and Angle Brackets as shown. Two 3½" Rack Strips represent the saw blades and are bolted by Double Brackets to the inside of the frame. The remaining portions of the saw blade unit have already been mentioned in the section dealing with the saw motion.

The model when completed should be carefully inspected for alignment and all moving parts lubricated so as to ensure freedom of movement. The model may be set in motion by either a Clockwork or an Electric Motor driving through the Pulley 14.

Parts required to build model Log Sawing Machine: 2 of No. 2; 1 of No. 2a; 4 of No. 3; 1 of No. 5; 4 of No. 8; 2 of No. 8a; 1 of No. 9b; 2 of No. 12a; 4 of No. 12b; 3 of No. 13; 4 of No. 15a; 1 of No. 15b; 4 of No. 20; 1 of No. 20a; 1 of No. 24; 2 of No. 25; 1 of No. 26; 1 of No. 27a; 2 of No. 30; 2 of No. 32; 54 of No. 37a; 51 of No. 37b; 2 of No. 53; 2 of No. 53a; 13 of No. 59; 1 of No. 95; 1 of No. 96a; 2 of No. 110; 2 of No. 136; 2 of No. 142b.

Prizes for Meccano Fun and Games

This competition, announced in our April issue, is still open and there is plenty of time for the preparation and despatch of entries. This is a variation from our usual model-building contests in that cranes, motor vehicles and similar subjects are not included. Instead competitors are required to submit examples of mechanical games and amusement devices made of Meccano. There is plenty of scope for ingenuity in planning and building such things as skittle boards, roulettes, bagatelle boards, bowling alleys and so on, and puzzles or mystery models of any kind also are ideal subjects. A clockwork or electric motor may be incorporated, but this is not absolutely necessary.

Building models for a contest of this kind is real fun, and there is a good chance for every reader, whatever his age, to win one of the many handsome cash prizes offered, for the contest is divided into two Sections, A for readers over 12 years of age and B for readers under 12 years of age. In each Section, there will be a First Prize consisting of a Cheque for £2/2/–, and Second and Third Prizes consisting of Cheques for £1/1/– and 10/6 each respectively. A number of consolation awards of Postal Orders for 5/– will also be presented in each Section.

Competitors should note that the actual model must not be sent. All that is required is a photograph or a good drawing with brief explanations where necessary.

The sender's age, name and address must be written on the back of the photograph or drawing, and this should then be sealed in an envelope addressed: *"Games Competition, Meccano Limited, Binns Road, Liverpool 13."* Entries must be posted in time to reach Liverpool on or before 31st May next.

Club and Branch News

WITH THE SECRETARY

SUMMER REPORTS

The summer programme is now well in hand in all Clubs and Branches. I have noticed in some quarters a tendency to send fewer and shorter reports of meetings in summer than in winter. This should not be the case. Whenever a Club is holding meetings, whether indoor or outdoor, reports should be sent along so that I can give the necessary accounts of these in the "*M.M.*" Will Leaders and Secretaries therefore make a special point of keeping me fully informed of their activities in the coming months? If more report forms are wanted, it is only necessary to let me know and I will send them along.

SEND PHOTOGRAPHS THIS SUMMER

Another thing that I particularly wish Leaders and other officials to bear in mind is the value of photographs. I know that it is difficult nowadays to get films, which are in short supply. It can be done, however, and if at all possible some record of outdoor proceedings during the summer sessions should be made. This does not mean taking a series of snapshots on all excursions or visits, as it did in the days of plenty. I suggest therefore that instead some particularly suitable position should be chosen in which to take a good group photograph of members, whether in a works that is being visited or on an excursion. It is not necessary that a group photograph for reproduction in the "*M.M.*" should be strictly formal; an informal one taken during a ramble, with members clearly at ease and enjoying themselves, is just as good, and often better! By the way, the advice, often repeated in the "*M.M.*," to make sure that military objectives are not included, should be borne carefully in mind.

Besides group photographs I like to reproduce portraits of officials of Clubs and Branches on this page. There are many of these, especially in new Clubs and Branches, who have not yet figured in this manner. I want all concerned to bear this in mind, and to send along portraits so that I can reproduce these along with notes on the Club represented. Every successful Club and Branch, and every one in which a good effort is being made to establish a Guild or H.R.C. centre, is worthy of recognition by the publication of a group photograph or of a portrait of a Leader, Secretary or other official.

BRANCHES RECENTLY INCORPORATED

458. RAVENS (DEWSBURY)—J. Mayman, 67, Ravens Avenue, Dewsbury.

459. WOODLANDS (HULL)—D. Kennington, 53, Scalby Grove, Hull.

460. STOCKTON—R. N. Fraser, 11, Hereford Terrace, Cowpen Estate, Billingham, Co. Durham.

J. C. Mulvagh is Secretary of the Kilroot M.C., of which he was the founder. This Northern Ireland Club was affiliated in January, 1943. Meccano Model-building and Woodwork have been the chief hobbies pursued. In addition the programme has included Treasure Hunts, General Knowledge Contests, Observation Tests, Rambling and Cycling. A good Library also has been accumulated.

CLUB NOTES

ST. MARY'S (TWICKENHAM) M.C.—A very successful Model-building Competition has been held, in which entries included a locomotive, an aeroplane, a steam engine and a circular saw. Table Tennis and Darts Tournaments also have been held. Further Model-building Evenings have been arranged, as well as Talks. An excellent Hornby Railway has been set up. Club roll: 9. *Secretary:* R. Davis, 26, Katherine Road, Twickenham.

KESWICK M.C.—The Club room has been extensively repaired and renovated, and new members have been enrolled. An Aircraft Recognition Section has been formed, and another interesting new section is concerned with geology and Roman remains. An outdoor Hornby Railway has been laid down in the field outside Headquarters. A special good conduct marks system has been introduced and there is keen competition. Club roll: 12. *Secretary:* I. Bently, 53, Blencathra Street, Keswick.

NEW ZEALAND

CHRISTCHURCH M.C.—A very encouraging annual report has been issued. Under the guidance of Mr. E. A. Gay, Leader in the absence of Mr. Ancall, members are doing excellent work. A permanent Club room has been secured and decorated. Electric light and power have been installed and the room is otherwise well fitted. Excellent Model-building has been carried on, with Competitions, and the Hornby Train Section too has done more construction and running work than ever before. An album is being compiled of portraits of members serving in the Forces. Members have enjoyable times at all meetings, which include supper. Club roll: 27. *Leader:* Mr. E. A. Gay, 625, Colombo Street, Christchurch C.1, New Zealand.

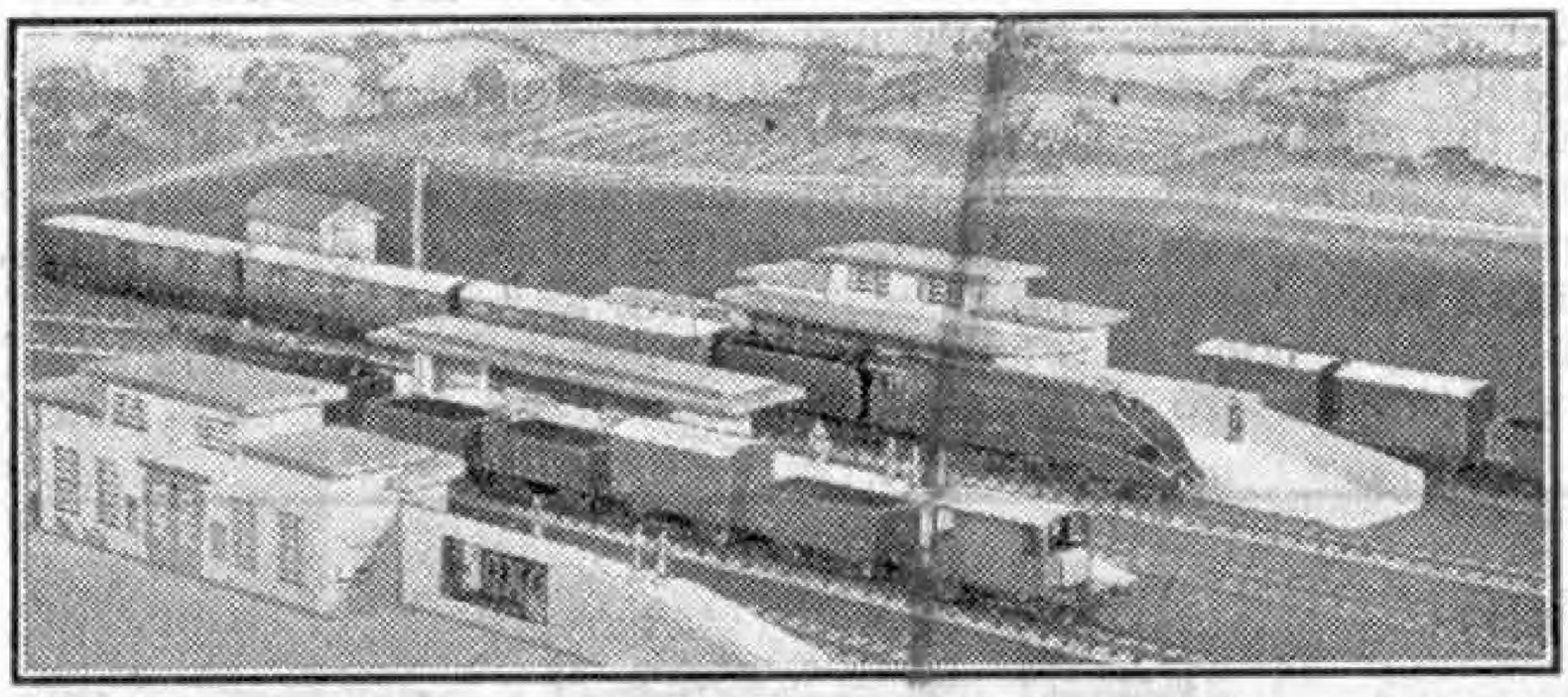
BRANCH NEWS

MORDEN—Splendid Track Meetings have been held regularly, and at one meeting an outdoor track was laid down and operated. Other events have included visits to engine sheds, marshalling yards and stations, Lectures by Mrs. Haines, Chairman, and by the Secretary, and a railway "Quiz" at which prizes were awarded to the winners. A special Signalman's Meeting was held to allow members to learn the bell code and its use. *Secretary:* P. C. Haines, 86, Camborne Road, Morden, Surrey.

DURHAM SCHOOL—The chief work of the new term has been the repair of the track, which has included the renewal of the electrical installation. The Library has been increased with advantage. Membership is now so large that Senior and Junior Sections have been formed. Competitions have been arranged and plans have been completed to operate the Branch layout to timetable, as before. *Secretary:* P. G. I. Green, Poole House, Durham School, Durham.

Running Hornby Dublo Clockwork Trains

A HORNBY Dublo clockwork train will give years of service if it is looked after carefully. It is most important that the wheels of the engine and all rolling stock, and the rails throughout, should be quite clean. Slipping of the driving wheels owing to greasy rails, or "woolly" running caused by dirty wheels and rails, reduces the power and the length of run of the engine.



Realistic station scene on a Hornby Dublo clockwork railway, showing the effective use of an Island Platform.

Correct lubrication is an obvious necessity. Never overdo things by attempting to use an oil can with any Hornby Dublo locomotives, or rolling stock. A single drop of thin oil should be applied by means of a "dip-stick"—a length of wire will do—to each moving part. Do not apply more; it is only wasted and very quickly will find its way to the wheel treads and the rails, exactly where it is not wanted!

Little precautions like this make all the difference to the fun to be had with Dublo Clockwork Trains.

It is often a temptation to push an unwound engine along the track "just to see how it looks." Never do this, however, as damage to the mechanism will result. Before winding up, always apply the brake by moving the left-hand cab lever to the rear, and make sure that the reversing lever is fully in the forward or the backward position according to the way you want the engine to travel. In winding see that the key fits fully on to the winding spindle; if it is only partly on it may slip, and continual use in this was will ultimately spoil the key and the spindle.

If we observe these various "do's and dont's" we may expect trouble-free running, and we shall be able to take the fullest advantage of the power and speed that is built into our Dublo engines. In addition we can make use of that regularity of performance that is one of the greatest charms of clockwork-driven model locomotives, in setting up a systematic scheme of running. This need not be according to a timetable, but it can follow a definite plan of operations, which is so much better than the merely haphazard running of trains.

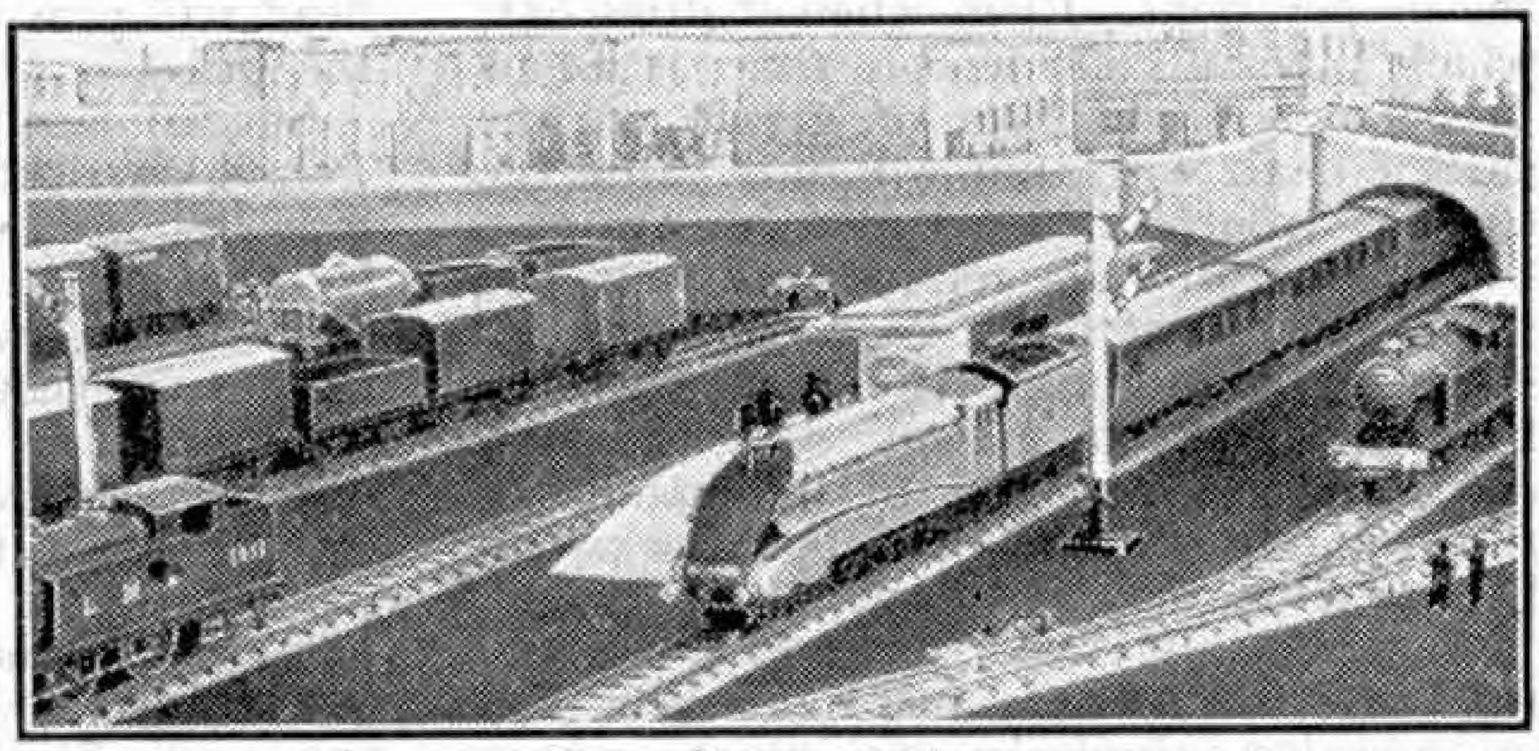
First of all we must find out just how many turns of the key are required to wind up the engine fully. Actually it is better to reckon in half-turns. Then we carry out experiments to discover how many half-turns are required to run different loads from point to point on the layout.

It must not be expected that the results will always work out in an exact number of half-turns. One particular figure may bring the train to a stop some distance short of the required point; one more half-turn will take it past the destination. So then we work to the lower figure, and count the number of "clicks" of the ratchet that are heard, and felt, as the key is turned the further amount that is required to bring the train to where we want it. This can be quite exciting, and once we have the results jotted down we can combine a series of movements into one particular "episode" of operations that will be quite realistic and certainly interesting.

In shunting and similar operations the engine may have to be wound a little for each move it makes. This is no disadvantage really, as we have to reverse the engine by hand in any case, and a little "key work" while the engine is stationary will not be much more bother. The results obtained make it worth while, and we should remember that shunting engines do not hurtle to and fro in the manner that is sometimes seen on what are otherwise quite well-conducted layouts. Shunting is a deliberate business in real practice.

Having reached this point we can organise our train service accordingly and introduce the names of the places between which our trains are run. On a clockwork line we cannot quite adopt the "mileage" system referred to in the article on page 137 of the "*M.M.*" last month; it is better to work on a point-to-point basis, so that, for example, so many circuits of the track represent the run from King's Cross to Peterborough, and so on. In this way we can build up quite a realistic journey for all kinds of trains. If we have a real timetable to work from in settling the different stopping points, so much the better.

Some readers have a prejudice against timetable working. Apparently they think it is too complicated, and not worth the trouble it involves. This is a mistake. There is no greater fun in the world than running trains to time, especially when two or three friends work together. And as for excitement—there is simply nothing like it! Try it for yourself. It will not be long before the fascination "gets you."



A stopping passenger train draws into the station while a goods train passes through.

Getting the Best from your Hornby Trains

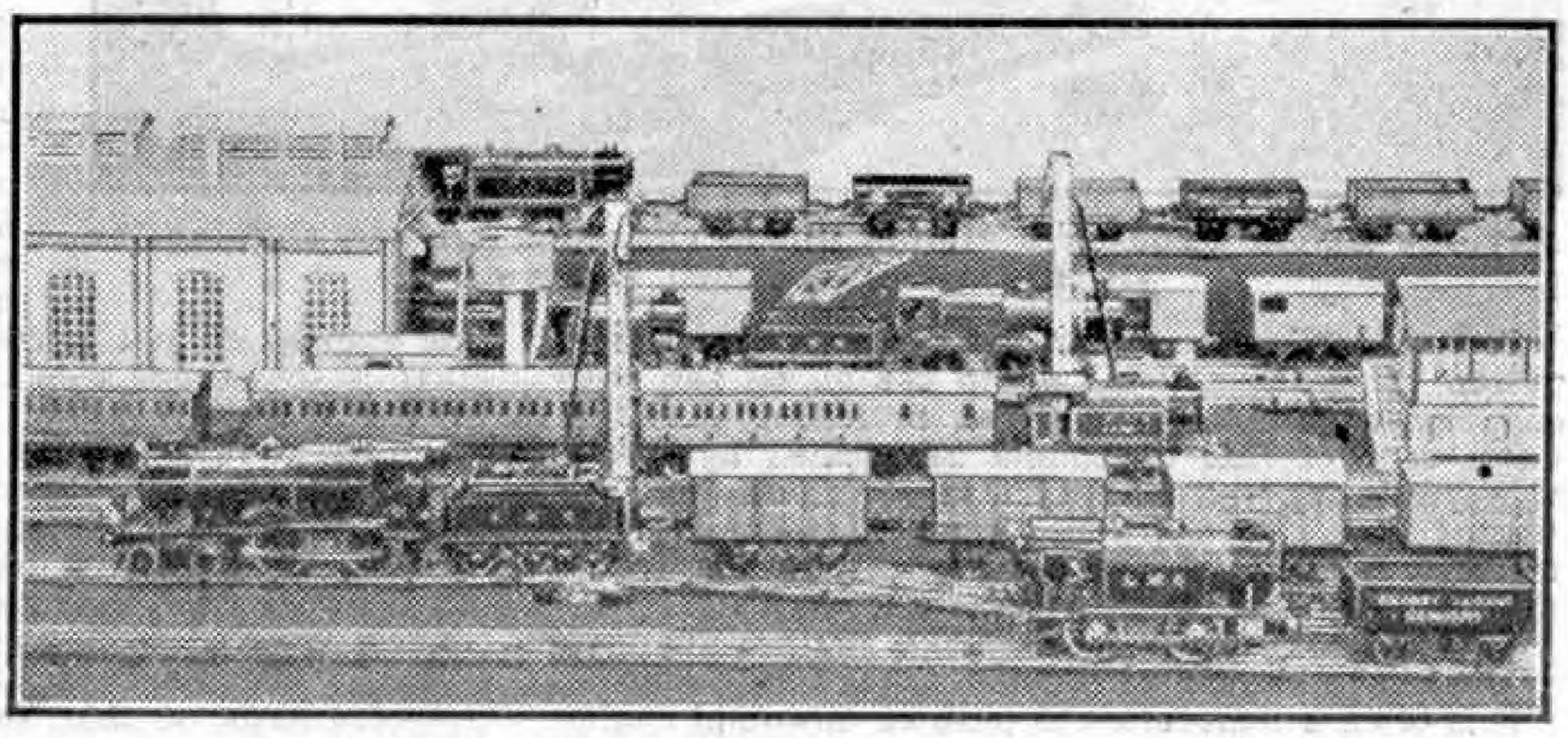
AMONG the queries addressed to us by Hornby Train owners we often find an old friend: "How can I stop my engine wheels from slipping?" The usual remedy of course is to examine the wheel treads, which are frequently found to be greasy; so we wipe them clean, but little or no improvement results. What do we look for next? We shall probably find that the track is greasy too from the continued passage over it of numerous vehicles, the bearings of which have most likely been over-oiled. In addition, if we have been somewhat generous in oiling the engine, the excess oil will have found its way to the track. So we carefully wipe the whole of the track, and to do the job thoroughly we must also deal with the wheels of the engine and rolling stock. A clean dry cloth usually does all that is necessary, but the wiping must be thorough.

Any obstinate deposit on wheels or track my require the use of a very little petrol on the rag. This job should be done outside, or at any rate well away from any fire or flame. When it is finished we are ready to start again with all track and wheels clean and dry, and we remember for the future that a little lubrication goes a very long way.

Never be tempted to use paraffin for these operations. Even when it dries out, which takes a considerable time, it seems to leave a slight film of grease on the surface dealt with that will only cause the slipping trouble to start all over again.

Speaking of rails reminds us that the track itself must be in good condition for satisfactory running. The rails must be true to gauge, a matter that is easily checked with the back of the handle of the winding key of Hornby Clockwork Locomotives, for this forms a rail gauge. If it can be slid freely along between the rails they are correct; any tight spots will be revealed, similarly any places where the gauge is slack. Here the rails should be eased either outward or inward as required, by gentle pressure of the finger and thumb. As regards electric track, each Hornby Electric Locomotive originally has packed with it a most useful Combined Rail Gauge, Screwdriver and Spanner. The rail gauge portion of this is used in a similar way to the clockwork key handle just mentioned.

Slight twists in the rail as a whole can usually be rectified by twisting them in the opposite direction, but care is required not to overdo this or the sleeper fastenings may be loosened and the rails spoiled. Flattened or distorted rail ends can usually be doctored by means of a small pair of pliers. These should not be allowed to grip the hollow rail head or they may spoil it. If a spare rail connecting pin is handy it can be slipped inside the end of the rail head while the pliers are used to operate on the web or flat portion of the rail. Instead of a connecting pin a nail of suitable diameter can be used, and its head will prevent it slipping too far inside the rail.

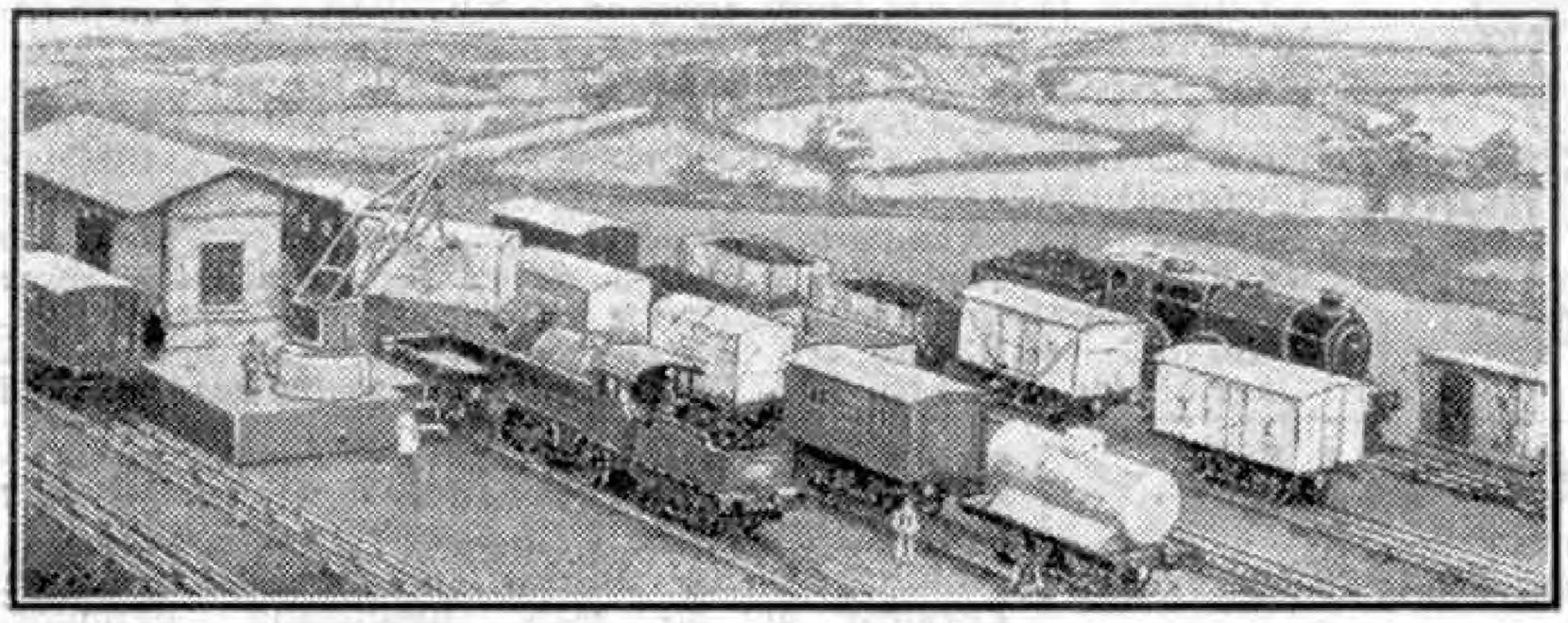


A busy scene on a large Hornby layout including sidings, main lines, an Engine Shed and a variety of Wagons.

Special care is necessary when adjusting Points, particularly if the moving or switch rails require attention. When set over for the one direction or the other, both ends of the switch rail concerned should line up perfectly with the corresponding fixed rails. As a rule a little bending will put matters right, more particularly at the facing or tapered end of the switch rail, which has to fit hard up to the stock rail, or the wheel flanges may bump and in extreme cases tend to "split the points" and cause derailment.

Rails should always settle down comfortably on the floor or table without

strain, and any sudden changes of level should be avoided, especially on curves. A flat firm foundation is always advisable and it is important to see that the correct number of rails are in use for the formation that it is desired to lay down. Another point is that curves and Points of 1 ft. and 2 ft. radius should not be mixed together in the same layout.



Activity at a goods station.

Engine bogies can sometimes be puzzling to the beginner in their behaviour, especially if the engine is not a new one. It may be pointed out here that the leading bogie on Hornby Locomotives has an important job to do. It is intended to support part of the weight of the engine and to assist in negotiating curves. To do so a light coiled spring is fitted to the bogie pin between the bogie frame and the framework of the engine. This spring should be slightly compressed when the engine is standing normally on a level piece of track. The spring thus exerts some pressure on the bogie and this helps to keep it down to the rails.

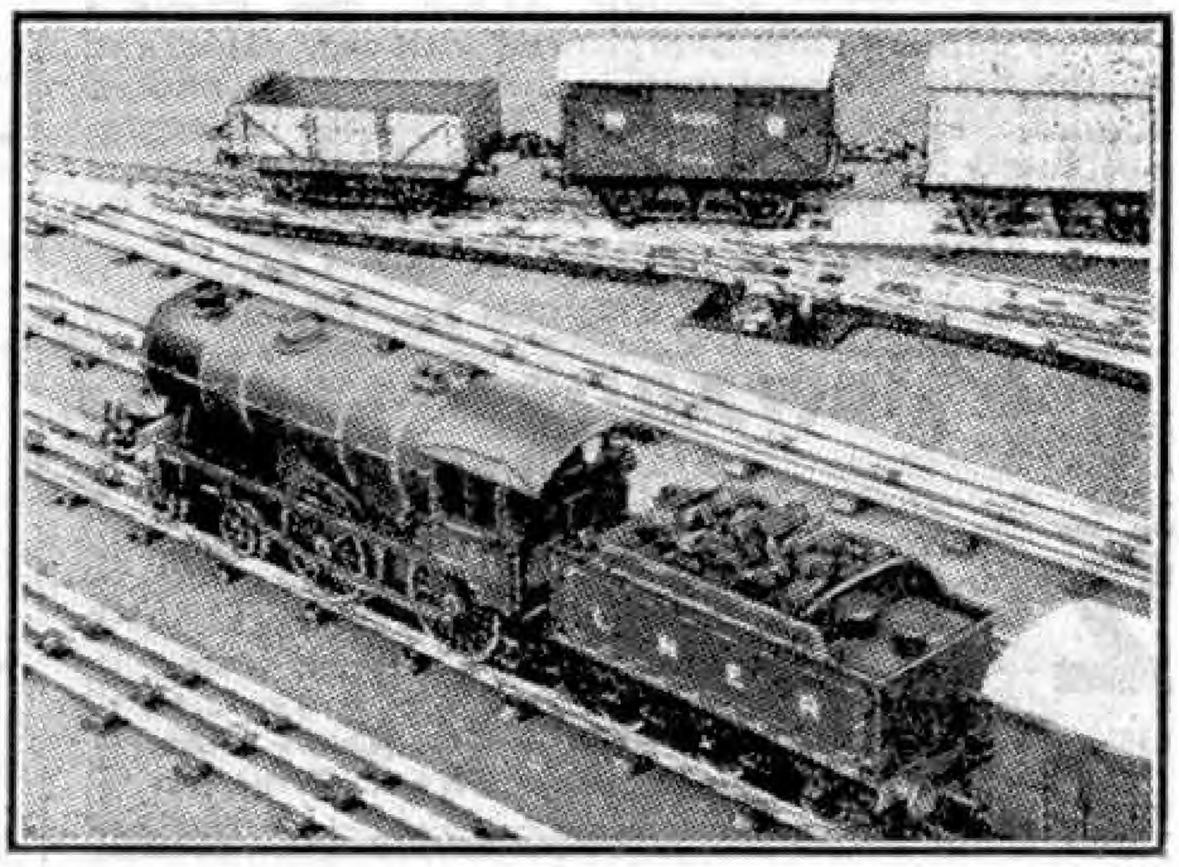
If the spring does not seem to be up to its work, remove the bogie assembly by unscrewing the bogie pin. Then take off the spring and stretch it a little so that it is elongated. Then, when the bogie is replaced and the engine is on the rails, see if there is just a little resistance when you try to lift each pair of bogie wheels off the track without disturbing the engine. Sometimes the fitting of an additional spring is an advantage; this should be put on the bogie pin and turned round and round so that it wraps itself round the spring already in position. It should then make a decided improvement.

Bogie wheels are small, and as the bogie as a whole is relatively loose when the engine is removed from the track, these wheels are liable to derangement or sometimes damage if the engine is put away carelessly. So derailments may be caused, even if the bogie spring is correct or has been adjusted as detailed previously. These may be due to the wheels being out of truth, and it is advisable to check the distance apart of the wheels on their axles. Hornby Locomotive bogie wheels should never be more than $1\frac{1}{8}$ in. apart, this distance being measured between the flanges or "back to back" of the wheels. As an average a measurement of $1\frac{3}{32}$ in. will be found just right.

Pony trucks as fitted at the rear end of the Hornby E220 Special Tank must naturally have a pivoting movement sideways. In addition they require some up and down play to allow for changes in level on the track. If such trucks are adjusted so that the wheels have about $\frac{1}{8}$ in. play both up and down from their normal rail level they should run perfectly.

Among the smaller details, couplings sometimes cause trouble because they have been damaged or distorted. Attention with a small pair of pliers will usually correct matters. Couplings that are stiff and fail to swivel properly can be freed by the use of a little oil. Finally, care should be taken to see that they are quite fair and horizontal; if they slope too much up, or down, they will not couple properly, and they will cause much annoyance to the operator, especially when trains are being shunted.

If the hints in this article do not help you, write to the Editor for advice.



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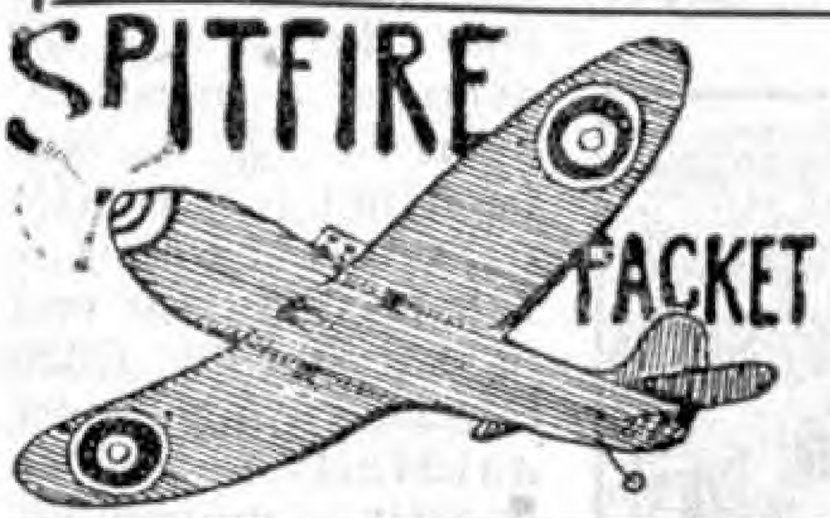

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thank the many clients who wrote expressing disappointment at the suspension of our Approval Service, and have much pleasure in stating that there is every possibility of this popular service commencing again in the near future. An announcement will be made next month, but if any readers interested would like to communicate with us, we should be pleased to send as soon as books are ready.

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For other Stamp Advertisements see pages 176 and viii.

Stamp Collecting

Perforations and Watermarks

WHEN the first adhesive stamps made their appearance in 1840 single stamps were cut from sheets with the aid of scissors. It was not long before a quicker and easier way of dividing the sheets was sought. Various schemes were tried and eventually the happy idea of punching rows of holes between the stamps became standard. These holes form the perforations, and they have become very important in the hobby of stamp collecting. The modern stamp collector indeed must know his "Perfs.," or at least he must know something about them, for differences in perforations help to identify different issues of stamps carrying the same design. This is particularly important at the present time, when so many new printings of British Colonial stamps are appearing.

The perforations on sheets of stamps are made by means of lines of punches that actually remove a tiny disc of paper at each stroke. Perforating machines take different forms. In one there is a simple straight line of punches, and the sheets have to be passed under it, moving them up step by step, to give the horizontal perforations, after which they are turned sideways and the process is repeated to give the vertical perforations. The more usual machine nowadays is the comb, which has a row of punches placed horizontally, with short rows at right angles, a shape that suggests the name. The comb punches the holes between two rows and between the stamps of one row at the same time, and as it is moved down the sheet it produces both horizontal and vertical perforations throughout.

Now the important thing about perforations is that they may vary in size with different issues. In order that a comparison can be made a standard has had to be chosen, and this is the number of perforations in a length of 2 cm. Interesting examples are given on this page. Here for instance is an Australian stamp, issued in 1913, which has 11 perforations in the standard length of 2 cm., while at the head of the page is a 2d. blue of Queen Victoria, issued in the middle of the last century, in which there are 16 perforations in the same length. The Sudan Air Mail stamp also illustrated on this page is Perf. 14, and the three stamps provide interesting comparisons.

It is not necessary to measure up a stamp and to count its perforations. This would be a tedious job, which is done far more easily with the aid of a perforation gauge bought from a stamp dealer. This has on it successive rows of dots, those of each row being a little larger and with their centres spaced a little farther apart than those of the preceding row. The rows represent the various perforations, and all that is necessary in measuring up a stamp is to move its edge along the rows until one is found in which the dots fit exactly into the perforations of the stamp. The number of perforations in the standard length is then read from the end of the row thus marked out.

Another point that should be noted is that there may be two perforations given for a stamp. For instance, in going through the catalogue it may be noticed that a certain stamp has Perf. $13\frac{1}{2} \times 12\frac{1}{2}$. In cases such as this the first figure refers to the top and bottom of the stamp, and the second to the sides.

I have referred to various schemes for separating stamps that were tried before perforations became standard. Of these the most popular was to make a series of short straight cuts by means of a toothed wheel, giving what is known as a roulette. The cuts were not always in a straight line, however, various shapes giving zig-zag, serpentine and saw roulettes, terms that are descriptive of the actual arrangements.

There was an interesting revival of rouletting with the introduction of the now well-known miniature stamps of South Africa, in which the stamps were perforated in groups instead of singly, with rouletting to separate the stamps in each group. For instance, the South African 1d. stamp illustrated at the foot of this page was grouped in threes, with the perforations round the group, and roulettes in the two spaces between. Both perforating and rouletting are well shown by this example, which actually is overprinted S.W.A. for use in South-West Africa.

Turning now to watermarks, the idea of using paper with these special devices is to prevent forgery. Watermarks have also become distinguishing features of stamps, however, and details of them are given in catalogues, along with those of perforations.

Every reader is familiar with the appearance of a watermark, but if not all he has to do is to hold up a sheet of good writing paper in front of a strong light. This mark is really a thinning of the paper itself, and is introduced while the paper is being made by the pressure of a revolving cylinder, called the dandy roll, on which devices made of wire or cut out of brass are fixed. The marks produced may take the form of letters or words, or of some special design, and two examples of watermarks on stamps are illustrated here.

Collectors can usually see the marks on their stamps by holding them up to the light, looking at the back, but in some instances it may be necessary to lay the stamp face downward on a black surface, or even to place a drop of benzine on the back of the stamp. This liquid is sold with special droppers by stamp dealers, and no naked lights of any kind should be near when it is in use, as it is highly inflammable. Another warning—modern stamps printed in photogravure should not be tested in this way, as the inks used on them would run and the stamp would be ruined.

In some instances the watermark is so arranged that a single complete design appears on each stamp. The spray watermark used on British

(*Continued on page 177*)

For other Stamp Advertisements see pages 174 and viii.

Stamp Gossip
and Notes on New Issues

The March Stamp Quiz

Entries in the March Stamp Quiz were on a very satisfactory scale, and it is clear that readers enjoy these competitions for themselves, as well as for their stamp interest. The first question asked which country issued the first stamp on which modern aviation was featured. Certain readers mentioned the U.S.A. air-mail stamp of 1918, but a 20 c. parcels post stamp of 1912 was earlier. It showed a biplane carrying mail.

The answer to our second question is the British Empire Exhibition stamp of 1924–25, which features the Wembley Lion. There have been animals on other British stamps, notably a smaller lion on stamps of 1911–12 and 1912, and credit was given for answers that included these. The third question showed readers at their best. Very few failed to give the U.S.A. 5 c. of 1934 and the Iceland 15–35 aur. of 1938 as stamps showing a geyser, and practically every competitor gave a formidable list of countries that have issued stamps showing volcanoes, including Japan, Iceland, Mexico, Nicaragua, Bolivia, Chile and so on.

The next question led to falls in many quarters. The first airmail service that can strictly be regarded as regular was that from Paris during the siege of 1870. One competitor referred to a pigeon post of 43 B.C., but he did not claim this as the one required!

The last two questions were well dealt with. The stamp bearing portraits of *four* British monarchs is the St. Helena centenary of 1934, 1d. value, which included portraits of William IV, Victoria, Edward VII and George VI; the smallest stamps in current use are those of South Africa, the well-known midget stamps used also in South-West Africa with the overprint S.W.A. Three of these stamps are illustrated on page 175.

The winner of the first prize of 21/- in this contest is A. A. Dawson, Inverness, and second and third prizes of 10/6 and 5/- each have been awarded to K. Kewish, Bootle, and D. Rayner, Riddlesden. Consolation prizes of 2/6 each have been well earned by L. B. J. Bearcroft, Lingfield, and R. R. Dowding, Gillingham.

New Printings

This month there are more new printings of British Colonials, distinguished in certain instances by new shades, of which two are illustrated on this page. One of these is the 2½d. Barbados, which appears in a new shade of blue, but with the familiar design reproducing the badge of the colony. The other is a new shade 3d., black and ultramarine, from the British Solomon Islands. In many respects the most interesting news in regard to British possessions, however, is the announcement that sets of stamps have been prepared in London for use in the dependencies of the Falkland Islands. These comprise the eight values of the Falkland Islands present issue from ½d. to 1/-, overprinted with the name of the dependency. The four dependencies are South Georgia, South Orkneys, South Shetlands and Graham Land.

This month we have a further example of a commemorative from the Argentine. This takes the form of a 5 c. issue, in light blue, commemorating the Week of the Sea. It shows head on views of three vessels of different types, and the wording in translation runs *"Prows that consolidate our greatness."*

Stamp Collecting—(*Continued from page 175*)

stamps during the last century and illustrated here is an example. Another with which readers should be familiar is a six-pointed star, used in two sizes on certain stamps of British possessions. Yet other watermarks that readers will find on many of their British Empire stamps, and should know, consist of a crown with the letters CC or CA underneath, together with one in which the letters CA appear over the crown.

Early in the present century a new form of watermark was introduced for the stamps of British Possessions. This is known as the Multiple Crown CA, and is a small design covering the whole of the paper, so that the design is repeated wholly or in part several times on each stamp. In 1921 a further change was made to what is known as the Multiple Script CA, in which the capital letters are in script, that is as if written by hand. This is shown in the lower of the two watermark illustrations on this page, and every collector will find many examples in his album.

It should be noted that not every stamp issued has a watermark. A notable example of a country that has not made use of watermarked paper is Rhodesia. Certain issues from that country, both before and after 1923, when the last general Rhodesian issue appeared and the distinction between Northern and Southern Rhodesia was made, were printed in South Africa, in one instance Cape of Good Hope stamps being overprinted, and these stamps do carry a watermark. The Southern Rhodesian commemorative stamp illustrated in our March issue was printed on paper intended for Union of South Africa stamps and this has for watermark the head of a springbok.

Timothy Hackworth—(*Continued from page 159*)

maintaining all motive power, providing men and material, and also fuelling and lubricating the plant generally. He set up his own establishment at Shildon, known as Soho Works, and here, although locomotive work formed the bulk of the business, Hackworth engaged also in general engineering activities. Stationary engines, machinery for mining, rope-making, woodworking and so on, hydraulic presses and engineers' tools all came from Soho Works. A winding engine supplied by him to the West Auckland Colliery was still in daily service in 1922. He also designed and built a type of stationary boiler that later became well known as the "Manchester" boiler, from the fact that its manufacture was taken up there by Daniel Adamson who had served under Hackworth at Shildon.

In 1840 Hackworth's connection with the Stockton and Darlington ceased, and he devoted himself to his own business. The locomotive remained his special line, although his general engineering activities were very wide.

Hackworth's last engine was named "*Sanspareil No. 2*," and was built in 1849 to incorporate the various ideas that his experiences suggested. It had the 2-2-2 wheel arrangement with inside cylinders, a special form of slide valve and valve gear, solid outside frames accommodating the bearings of the leading and trailing wheels, the driving bearings being carried on the inside frame. The boiler was of specially good construction, and various points in the design of the engine as a whole were the subject of a patent taken out jointly by Hackworth and his eldest son. "*Sanspareil No. 2*" fully realised the expectations of its designer and builder and made successful trips on several railways. Hackworth claimed it to show an economy of 25 per cent. over the best engines of the day.

Soon after the completion of this engine Hackworth's strength began to fail and he died in June, 1850.

FOUR HUNDRED TREES IN MY BACKYARD

By KAY CAMPBELL

There are thousands of people who see the coldest winters through without a single lump of coal, which the city dweller regards as essential. Hundreds of farms in this country burn nothing but peat and wood, and what sight is more cheery than a big old-fashioned grate with blazing crackling logs? In Canada most of the country people burn wood, because coal is not easy to get while wood is plentiful. We live a simple life. When our fuel supply gets low, we take an axe, harness up a couple of horses to a low, wide sleigh and hit out for the nearest forest. Incidentally, the forest is free to all who wish to use it.

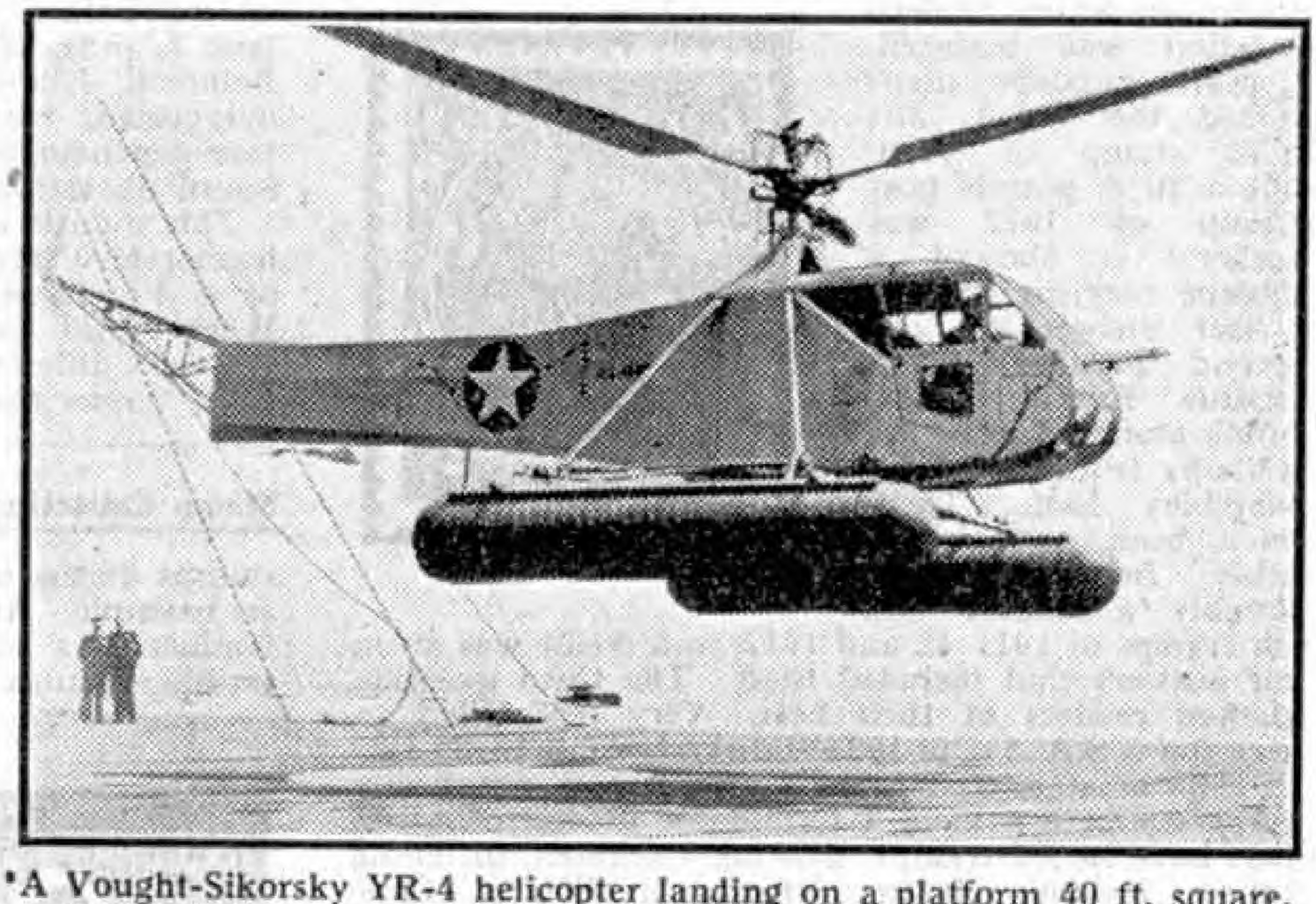
Usually by this time the snow is deep. In the drifts between the trees men are often waist deep and they can only cut the trees to within two or three feet of the ground. From 35 to 40 good sized trees are considered a fair load for the horses, not giant oaks of course, but usually tall white poplars. It is quite usual to burn about 400 trees in a winter, cut up by a travelling sawing outfit into lengths for the cookstove and heaters.

In those days, I longed for life in the city. "Oh," I thought, "the luxury of coal for central heating! No dust and every place so warm." Now I am in England I would give a lot to see 400 trees neatly stacked in my backyard. I have noticed though that wood in this country does not burn well unless it is well seasoned. The climate is the reason for that. England does not get either extreme heat or cold, and consequently the wood does not easily dry out. So even though I possess an axe and a forest is at my door, I cannot solve my coal problem that way.

A WORD THAT IS MISUNDERSTOOD

By E. R. MCCARTER

Here is a little problem that may interest "*M.M.*" readers. When cycling in Kirkcudbright I fell in with another cyclist and until our ways parted we went on together. After a time he remarked "*You don't ca as often as I do*," pronouncing the strange word "caw." What did he mean?



A Vought-Sikorsky YR-4 helicopter landing on a platform 40 ft. square. Photograph by courtesy of the United Aircraft Corporation, U.S.A.

The problem is partly literary and partly mechanical. I was frankly puzzled for a few seconds myself, and if I had only newly come from my native Northern Ireland I would probably have remained puzzled; as it was, enlightenment soon dawned on me.

A great deal of confusion exists because there are two typical Scottish dialect words, identical in sound, but very different in meaning. The first is ca', which is simply a curtailed form of call as in Burns's line, "*You see yon birkie ca'd a lord*," while the other is "ca," without the apostrophe, as the word is complete as it stands.

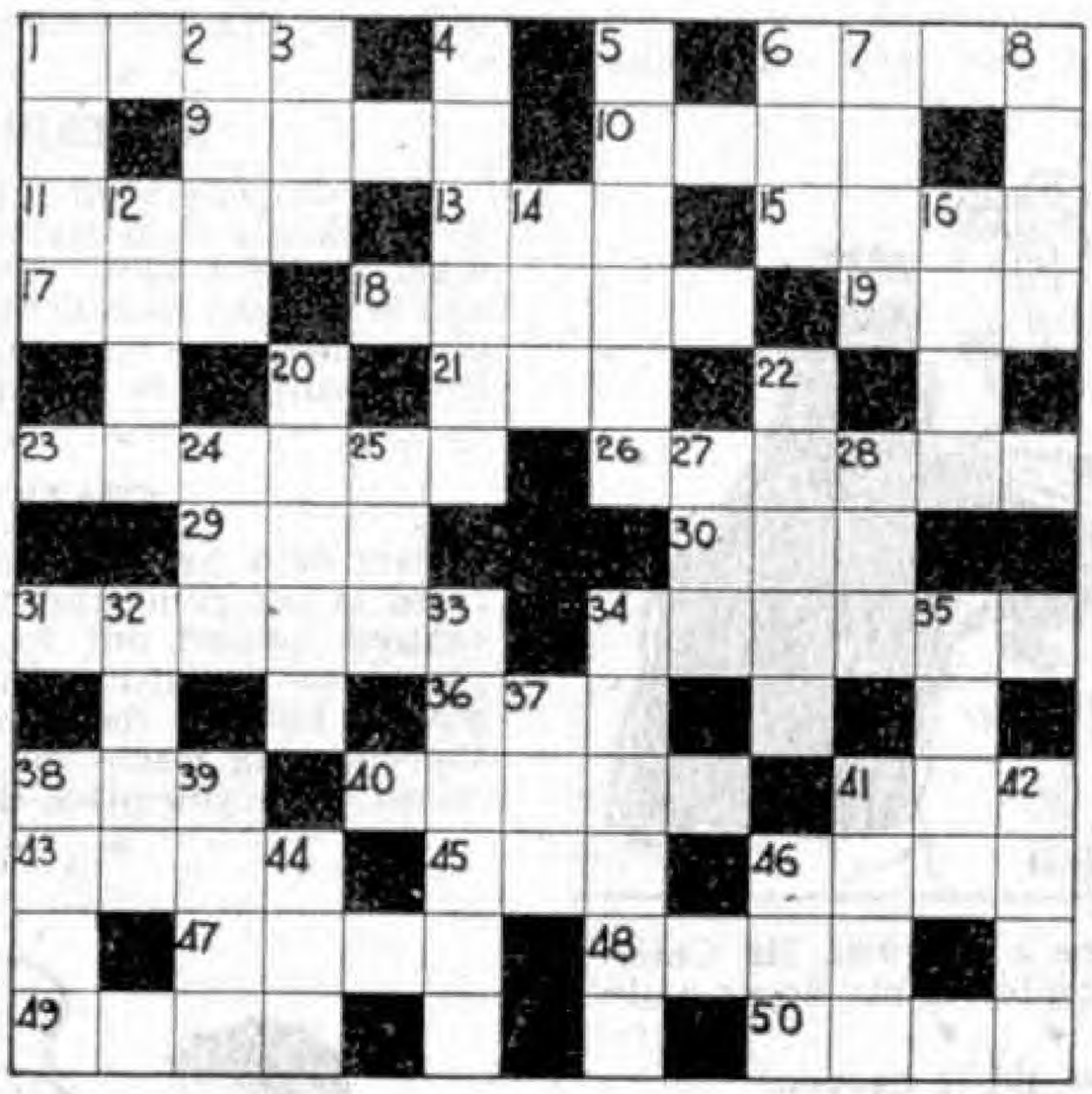
The meaning of the second word is rather difficult to define, for it expresses a wide range of meanings such as pull, push and drive, but all agreeing in implying the expenditure of energy. It is this "ca" that we hear in the familiar line "*Ca the yowes to the knowes.*" Here "call" would make no sense, for sheep do not come when they are called. "Ca" here means "to drive." Consequently my companion meant that I did not push on the pedals as often as he did. This was quite correct, for I was using the pretty high top of my three-speed gear, whereas he was riding a machine with a fairly low fixed gear, necessitating his "caing" oftener.

This word can be often heard in Scotland, particularly in country districts. Two men might be turning the wheel of some machine, taking spells at it, and one, getting tired, might say to the other "*It's your turn now to ca the wheel.*" The well known words "Ca canny," too, mean to go or do something cautiously; they have nothing to do with calling, which would be quite unintelligible here.

Recently I read an article on whales, in which the writer said the "Ca-ing Whale," was so called because it made a roaring noise to frighten its prey. He had obviously assumed that "ca-ing" was a simplified version of "calling." Actually, "Ca-ing Whale" means "Driving Whale," so called because it cas or drives before it its prey, millions of minute marine creatures.

Competitions! Open To All Readers

May Crossword Puzzle



CLUES ACROSS

1. Ramble (4)
6. Grand (4)
9. Stoop (4)
10. Nobleman (4)
11. Uniform (4)
13. Rent (3)
15. Gown (4)
17. Kindled (3)
18. Foghorn (5)
19. Pull (3)
21. Bog (3)
23. Leave (6)
26. Idle (6)
29. Past (3)
30. Curve (3)
31. Shrewd (6)
34. Indifference (6)
36. Populace (3)
38. Edge (3)
40. Revile (5)
41. Plump (3)
43. Figure (4)
45. Devoured (3)
46. Valley (4)
47. Scorch (4)
48. Necessity (4)
49. Head (4)
50. Join (4)

CLUES DOWN

1. Stagger (4)
2. Aid (4)
3. Males (3)
4. Floating free (6)
5. Regret (6)
6. Sin (3)
7. Stratagem (4)
8. Company (4)
12. Wicked (4)
14. Rage (3)
16. Brought forth (4)
20. Indefinite (5)
22. Rustic (5)
24. Tap (3)
25. Decompose (3)
27. Knock (3)
28. Feign (3)
32. Slipped (4)
33. Enlist (6)
34. Inattentive (6)
35. Cure (4)
37. Abroad (3)
38. Flexible (4)
39. Pillar (4)
41. Vanish (4)
42. Take care of (4)
44. Shelter (3)
46. Moisture (3)

This month's crossword puzzle will be found to follow the lines of the previous ones we have set on this page, all of which have proved remarkably successful. Every effort has been made to provide a fair and interesting puzzle, without any traps in the form of alternative solutions. The clues are all perfectly straightforward, and every word used can be found in Chambers' or any other standard dictionary. The rules that govern the solution of crossword puzzles are by now so well known that is is unnecessary to give any further explanation of the requirements of the competition.

As usual, there are two sections in the competition, for Home and Overseas readers respectively, and in each prizes of 21/–, 10/6 and 5/– will be awarded for the best solutions. If necessary judges will take neatness and novelty into consideration when making their decisions.

Entries should be addressed "*May Crossword, Meccano Magazine, Binns Road, Liverpool 13.*" The closing date in the Home Section is 30th June; that in the Overseas Section is 30th December.

Do You Know These Tunnels?

For our railway contest this month we turn to tunnels, all over a mile in length. The great tunnels of this country and of others are all familiar by name to every reader of the "*M.M.*," whether he regards himself as a railway enthusiast or not, and so this contest is one that is open in every sense to every reader.

The form that the competition takes is of interest, and helps to make the competition one for all readers. Below is a series of 12 clues, each of which when properly examined leads naturally and easily to a tunnel name. All that readers have to do therefore is to decide which tunnels are indicated by the clues, and to write these in order on a postcard, putting the number and the name in each case.

Here are the 12 clues:

1. Bore beneath a bore;
2. A fixture and there seems nothing beyond it;
3. A number of trees;
4. Famous statesman;
5. Practise a noble art;
6. Northern river;
7. Not much use for thinking;
8. Sounds high up rather than low down;
9. Scottish appearance, but in U.S.A.;
10. Irish, but in Canada;
11. An animal by a stream;
12. Isn't this a waterfall?

As usual, there will be separate sections in this contest for Home and Overseas readers, and in each of these prizes of 21/–, 10/6 and 5/– will be awarded for the best lists of solutions. Entries should be addressed "*May Tunnels Contest, Meccano Magazine, Binns Road, Liverpool 13,*" and competitors must not forget to write on their postcards their own names and addresses in full. The closing dates in the contest are Home Section: 30th June; Overseas Section: 30th December.

May Photographic Contest

This month's contest is the 5th in our 1944 series, and in it, as usual, prizes are offered for the best photographs of any kind submitted. There are two conditions: 1, that the photograph must have been taken by the competitor, and 2, that on the back of each print must be stated exactly what the photograph represents. A fancy title may be added if desired, but entries on which the conditions stated above are not observed will be disqualified.

Entries will be divided into two sections, A for readers aged 16 and over, and B for those under 16, and all entries must be clearly marked with the section letter. They should be addressed: "*May Photographic Contest, Meccano Magazine, Binns Road, Liverpool 13.*" There will be separate sections for Overseas readers, and in each section prizes of 15/– and 7/6 will be awarded. Closing dates: Home Section, 31st May; Overseas Section, 30th November.

Fireside Fun

"What have you bought that scraggy lot of hens for?"
"For profits, of course."
"Oh, prophets! I thought they were patriarchs."

* * * *

"How did you first become a cannibal, Mr. Chief?"
"I began as a little boy, by biting my finger nails."

* * * *

"I see Mike's dead. How did it happen?"
"He was cleaning a skyscraper window and stepped back to admire his work."

* * * *

"Look, mother. That man hasn't a single hair on his head."
"Hush, Betty. He will hear what you say."
"Oh! I am sorry. Doesn't he know it?"

* * * *

Prison Visitor: "What brought you here, my man?"
Convict: "I followed the advice of an advertising slogan."
Prison Visitor: "Indeed, what was that?"
Convict: "Make money at home."

* * * *

Orator: "And vote therefore for the man who has done most to arouse the working classes—"
Heckler: "Can't. He's dead."
Orator: "Who is?"
Heckler: "The man who invented the alarm clock."

* * * *

Trainer: "Can't you reduce some more?"
Jockey: "I haven't eaten for a week and to-day I cut my nails."
Trainer: "Go home and shave."

BRAIN TEASERS

THAT'S IMPOSSIBLE, SURELY!

Do you know any way of dropping a lump of sugar into a cup of tea without wetting it? When you have solved this easy one try the following. A ring is suspended by a thread from the cork of a bottle, so that the ring is inside the bottle. How would you make the ring fall without touching the bottle?

* * * *

A SPENDING PROBLEM

In a draper's shop a lady bought one length each of two kinds of material, one at 3/4 a yard and the other at 4/8 a yard. Altogether she bought 24 yards and when she looked at the bill she found she had given the same amount of money for each length. How many yards of each did she buy? T.K.C.

* * * *

CRAZY FOOTBALL

Part of a football match report got slightly confused at one point and read as follows: "The ball was centred, passed out to the right wing, kicked off, placed to the inside forward, headed over the bar, pushed towards the corner flag, and intercepted by the opposing inside right." Seven events were described. Can you place these in their correct order?

* * * *

ROWS AND ROWS

Soldiers were arranged in rows for a special occasion. With six less in a row there would have been six more rows, and if there had been six more in a row the number of rows would have been four fewer. How many soldiers were there? B.I.N.

* * * *

SOLUTIONS TO LAST MONTH'S PUZZLES

Our first puzzle was a plain catch. In solving it most people simply add the weights together to get $2\frac{1}{2}$ tons, forgetting that there are four faces to Big Ben, so that the total weight of the hands is 11 tons.

The code in our second puzzle is a simple one. The letter A is represented by the figure 2; to get the succeeding letters of the alphabet 3 is added in turn. Thus E is 14, D is 11 and N is 41, so that the first name in our list is EDEN. The remaining names are: EISENHOWER, TEDDER, STALIN, BEVIN, CHURCHILL, ROOSEVELT and MONTGOMERY.

In the bicycle race in our third puzzle John is 30 yards further behind every time James passes the starting point. It will therefore take 10 laps for him to fall 300 yards behind, at which point James catches him up.

The names in our fourth puzzle are KONIEV; LEESE; CLARK; FRASER; ALEXANDER; DE GAULLE; TIMOSHENKO; and HARWOOD.

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Readers' advertisements are published as soon as possible; inclusion in the first issue after receiving them cannot be guaranteed.

Small Advertisements. 1/8 per line (average seven words to the line), or 20/– per inch (average 12 lines to the inch). Cash with order.

Display. Quotations for space bookings, and latest net sale figures, will be sent on request.

READERS' SALES AND WANTS

SALES

Good condition, Hornby No. 4 Station; No. 2 Goods Platform; No. 2 and No. E1 Level Crossings; Acute Angle Crossings; No. 2E Signal Cabin; Platelayers' Hut; No. 2 and No. 1 Turntables; Signals, No. 1 Distant and Home, No. 2 Double Arm, No. 2E Distant, No. 2 Junction Home, No. 2E Junction Distant, M Home; "Meccano Magazines," Feb. 1938–Nov. 1943, two copies missing; "Trix" Transformer. What offers?—Bicknell, Dorminton, Halstead, Sevenoaks, Kent.

Raycraft Burglar Alarm Kit, complete with Projector, £4/10/–; Mains Bell Transformer (3.5, 8v.), 5/–; Ferranti Mains 6v. Transformer, 10/–; Electric Bell, 2/6; Ammeter (0–20 amps.), 10/–; a few 2-Pin Mains Fittings; Steam Engine with self oiling Piston, £1; Electric Motor, EO20, 5/–. All in good condition. Stamp please.—Boughton, Park Farm, Gt. Missenden, Bucks.

"M.M.'s," 1940–43, all in binders, new condition, 70/–.—Callender, 20, Magdala Road, Cosham, Hants.

WANTS

Minic Toys; Magic Motor; Steamship; any Mechanical Toys; Hornby Electric Locos. Must be in good condition. Very good prices given.—Salmon, Ty-Clyd, Criccieth, N. Wales.

April, 1943, "M.M." Must be in perfect condition.—Box No. MM.102.

E120 Motor wanted, would purchase Set if necessary; also Trix Railway Parts.—Rodway, Snowford Crest, Long Itchington, Nr. Rugby.

Bassett-Lowke, Gauge "0" Steam Loco. and Tender.—Tiller, 2, Stanley Road, St. Denys, Southampton.

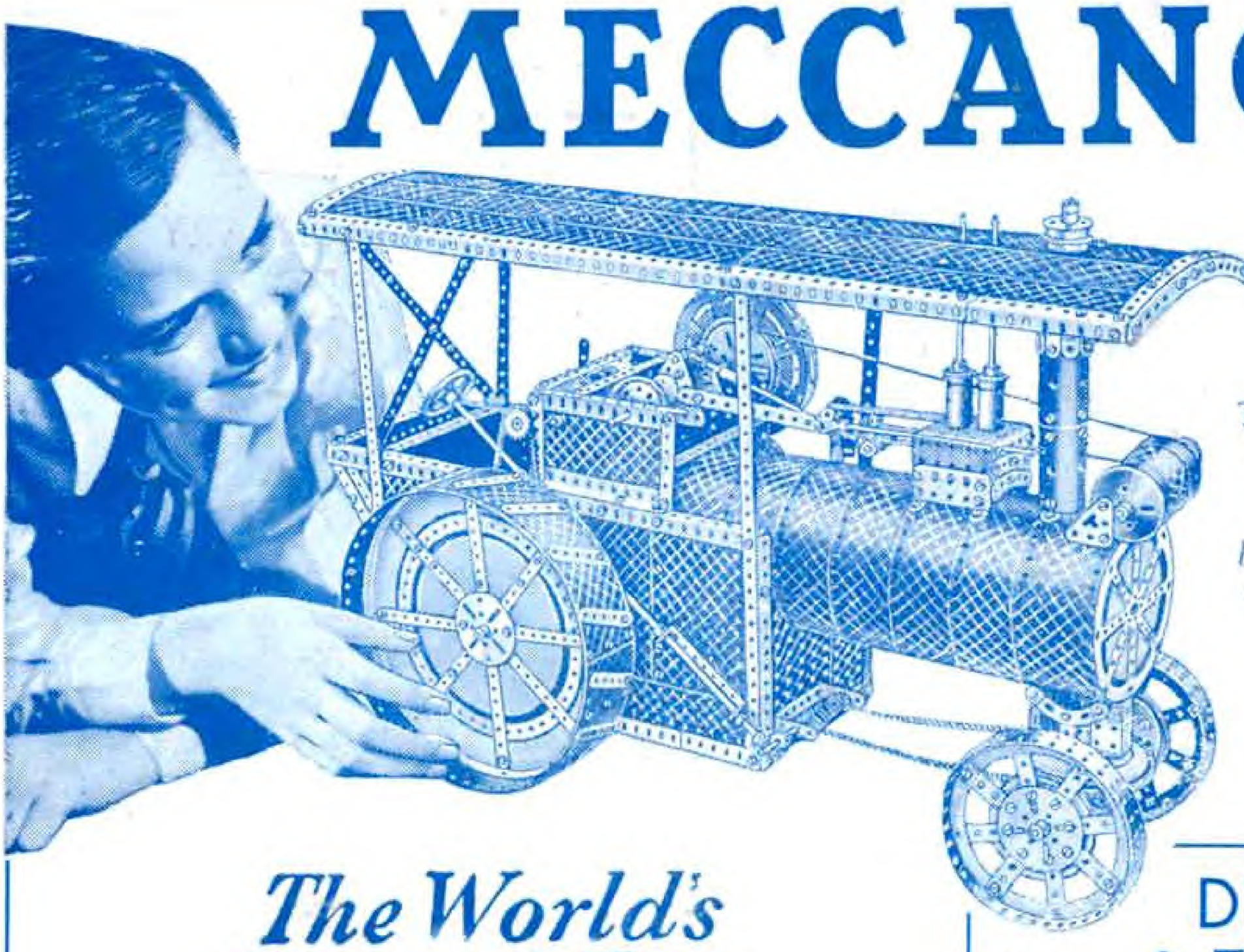
Trix Twin 0–4–0 Loco.; good condition; L.N.E.R. preferred.—J. Twell, Maud Foster, Horncastle Road, Boston.

EXCHANGES

Exchange Only. Mills Episcope (for 230-250 volts A.C.); Junior Typewriter; Model Steam Engine; 8 vols. "Children's Encyclopædia"; 1 vol. "Hobbies and Handicrafts"; also quantity of Foreign Stamps, all excellent condition; For: "0" Gauge Electric Locomotives; Rolling Stock; Amount Permanent Way; Steel, Brass, or Tinplate, made up or in parts; also Accessories; or same in "00" or both. Will exchange separately.—Bentley, 15, St. George's Gardens, Denton, Manchester.

Exchange Hornby Dublo Transformer No. 2, 250 volts, in perfect condition, for Two No. 2 L.N.E.R. Corridor Coaches.—Glassey, Ward 6, Ashludie Hospital, Monifieth, Scotland.

MECCANO



This splendid model of a Traction Engine is built entirely of standard Meccano parts.

The World's Greatest Toys

We are sorry that we cannot supply these famous toys to-day, but they will be ready for you again after the war. Look out for the good times coming!

HORNBY TRAINS

DINKY TOYS

De Havilland "Flamingo." Used by R.A.F. for transport and communication work.

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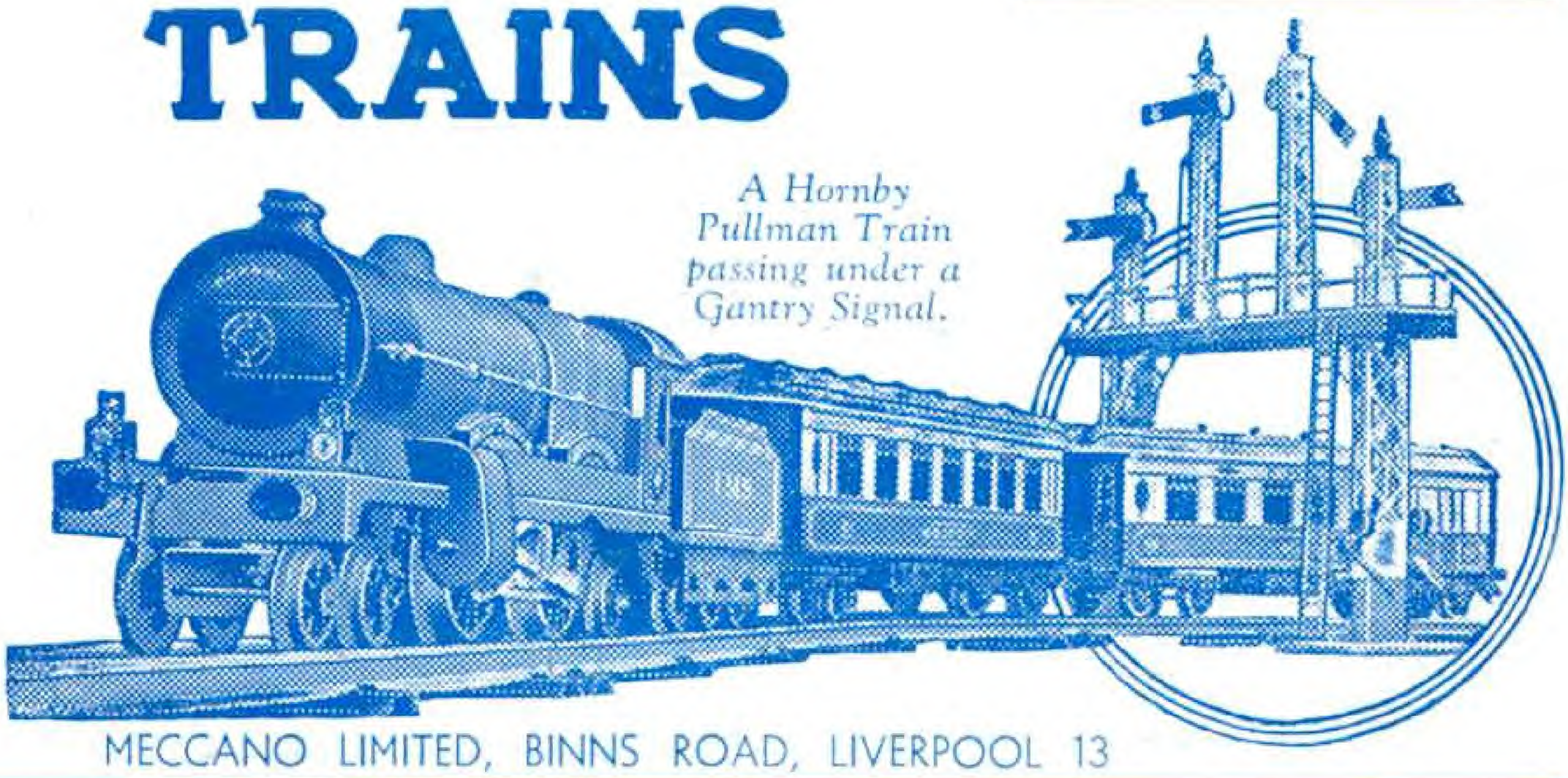

A Hornby Pullman Train passing under a Gantry Signal.

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